USAARL Report No. 95-23

U. S. Army Rotary-Wing Emergency Egress Study

By

Timothy R. Swingle

Research Support Division

May 1995

U.S. Army Aeromedical Research Laboratory
Fort Rucker, Alabama 36362-0577

Notice

Qualified requesters
Qualified requesters may obtain copies from the Defense Technical Information Center (DTIC), Cameron Station, Alexandria, Virginia 22314. Orders will be expedited if placed through the librarian or other person designated to request documents from DTIC.

Change of address
Organizations receiving reports from the U.S. Army Aeromedical Research Laboratory on automatic mailing lists should confirm correct address when cor-responding about laboratory reports.

Disposition
Destroy this document when it is no longer needed. Do not return it to the originator.

Disclaimer
The views, opinions, and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other official documentation. Citation of trade names in this report does not constitute an official Department of the Army endorsement or approval of the use of such commercial items.

Reviewed:

JAMES E. BURKE
MAJ, MS
Director, Research Support Division

Released for publication:

ROGER W. WILEY, O. D., Ph.D.
Chairman, Scientific
Review Committee

DENNIS F. SHANAHAN
Colonel, MC, MFS
Commanding

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) USAARL Report No. 95-23	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION U.S. Army Aeromedical Research Laboratory 6b. OFFICE SYMBOL (If applicable) MCMR-UAR-FS	7a. NAME OF MONITORING ORGANIZATION U.S. Army Medical Research and Materiel Command
6c. ADDRESS (City, State, and ZIP Code) P.O. Box 620577 Fort Rucker, AL 36362-0577	7b. ADDRESS (City, State, and ZIP Code) Fort Detrick Frederick, MD 21702-5012
8a. NAME OF FUNDING/SPONSORING ORGANIZATION 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State, and ZIP Code)	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.
11. TITLE (Include Security Classification) (U) U.S. Army Rotary-wing Emergency Egress Study	
12. PERSONAL AUTHOR(S) Timothy R. Swingle	
13a. TYPE OF REPORT Final 13b. TIME COVERED FROM _____ TO _____	14. DATE OF REPORT (Year, Month, Day) 1995 May 15. PAGE COUNT 33
16. SUPPLEMENTARY NOTATION	

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Emergency exit, egress, helicopter exit, NATO AGARD
15	01		
08	09		

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

This study was conducted in support of a NATO AGARD (Advisory Group for Aerospace Research and Development) effort to survey emergency egress mechanisms for all helicopters. This particular study deals with U.S. Army helicopters. The study consists of photographs and diagrams of each exit system, and a brief synopsis of the emergency egress procedure including: location and description of the operating mechanism, location of and ease of viewing the operating instructions, force required to operate, direction of opening, size of aperture and restrictions to evacuation, overall ease of operation and access for crews, and extent of instructions in the operators manual.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION Unclassified
22a. NAME OF RESPONSIBLE INDIVIDUAL Chief, Science Support Center	22b. TELEPHONE (Include Area Code) (334) 255-6907 22c. OFFICE SYMBOL

Acknowledgments

I would like to thank CPT David Parker, commander, A Company, 1/223th Aviation Battalion, ATB, for allowing me to utilize his aircraft. Also, I wish to thank the mechanics of DynCorp at Fort Rucker for assisting me in the study. For a variety of assistance, I am grateful to these coworkers at USAARL: Linda Messer for her background research; Larry Thomas for his photography; James Burkett for manufacturing of the test equipment; Udo Volker Nowak for his editing; and John Sowell for his publishing support.

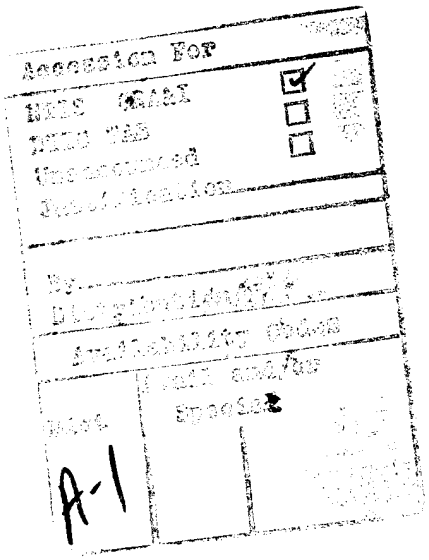


Table of contents

List of figures

Table of contents (Continued)

Background

This study was a partial effort to survey the emergency egress mechanisms for all helicopters in support of a North American Treaty Organization (NATO) Advisory Group for Aerospace Research and Development (AGARD). This part of the study deals only with U.S. Army helicopters.

A literature search revealed the only U.S. study of this kind had been a survey of egress from U.S. Navy fixed-wing jet aircraft over water. A study was done by BioTechnology, Inc., to see how best to present the emergency egress information in the manual of the Naval Air Training and Operating Procedures Standardization Program (NATOPS). The study concluded that to best way to facilitate learning was for the manual to strongly emphasize pictorial descriptions. Also, the study's authors found that presentations with pictorial support had a higher rate of learning and retention (Post and Kershner, 1979).

The Naval Aerospace Medical Institute then was tasked to prepare mechanicals (layouts) on emergency egress to be included in all aircraft NATOPS manuals. This tasking also included standardization of the mechanicals. The process for manual standardization was developed by Lee, 1990. This paper follows Lee's suggested presentation method.

Method

The intent of the study was to evaluate various factors affecting the egress from U.S. Army helicopters. Factors include: location and description of the operating mechanism, location of and ease of viewing the operating instructions, force required to operate, direction of opening, size of aperture and restrictions to evacuation, overall ease of operation and access for crews, extent of instructions in the operator's manual, and finally photos of each apparatus.

Operator's manuals for each aircraft were reviewed and pertinent information was extracted to include system descriptions, operating procedures, and equipment diagrams. In all the operator's manuals, chapter 2 describes systems and chapter 9 covers emergency procedures.

The study was conducted at Cairns Army Airfield, Fort Rucker, Alabama. Aircraft used were from "A" Company, 1/223 Aviation Battalion. The results were obtained by attaching a Chatillon DPP-25 force gauge to the emergency egress handles on the aircraft and operating the mechanism according to the operator's manual. All handles that required safeties were safe tied with 0.020" safety wire. The cockpit exit restrictions common to most U.S. helicopters are the collective (left side only), the cyclic, and armor plating.

The aircraft studied were the UH-1 Huey, the UH-60 Black Hawk, the AH-1 Cobra, the AH-64 Apache, the OH-58 Kiowa, and the CH-47 Chinook. The study was divided into two areas of concentration for each aircraft: the cockpit egress and the cabin area egress.

Note: All nonphoto figures are found in the Appendix.

Results and Discussion

UH-1 Huey

Cockpit --- Emergency exit release handles are located on the front of the cockpit doors, directly above the upper hinge. The T-shaped handles are yellow and black striped. Operating instructions are readable easily and located on the front door frame above the T-handle, as shown in Figures 1 and 2. Pulling the T-handle upwards pulls a cable which releases pins through the door hinges. Once the pins come out, the hinge separates, and the cockpit door is free to fall away. Force required to break the safety and disengage the pins is 25-30 lbs. The door then will fall off by itself or with slight pressure upon it. The opening then is the size of the door frame minus the restrictions of the cyclic, armor plate and the collective. The operator's manual displays the emergency exit release handles, but does not have them labeled as seen in the Appendix, Figure 3. Emergency procedures in chapter 9 of the operator's manual are simple and adequate. The cockpit

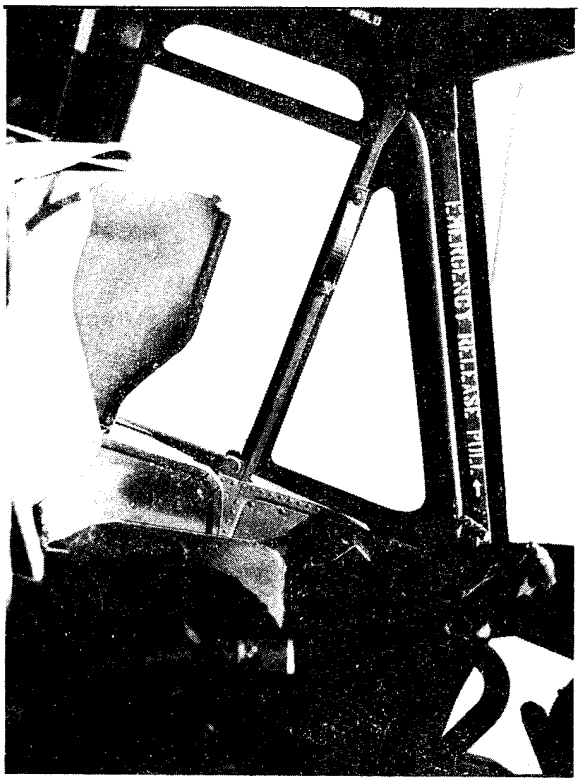


Figure 1. UH-1 cockpit area.

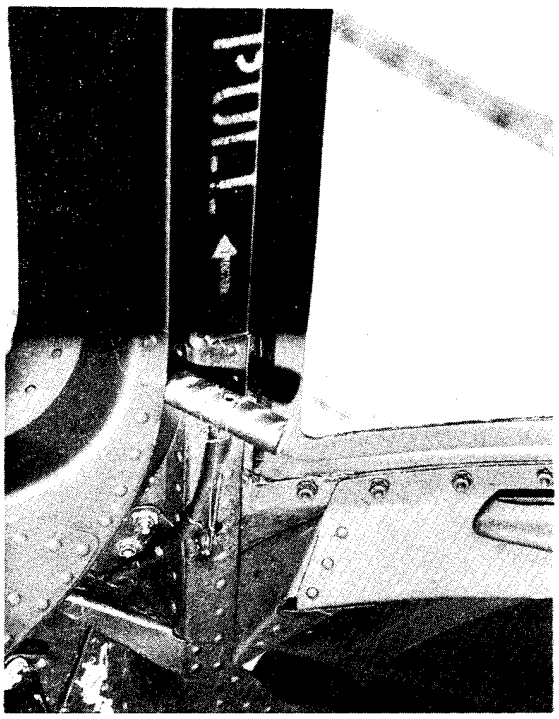


Figure 2. UH-1 cockpit emergency egress handles.

doors jettison easily and quickly. The armor protection panel on the seat is difficult to slide rearward and takes both hands to operate. With the panel forward, it is difficult to egress and this is the procedure's weak link.

Cabin --- The cabin door window emergency release handles are located at the bottom center of each window. The handles are yellow and black striped. Operating instructions clearly are visible as can be seen in Figures 4 and 5. Lifting up on the handle with 20-25 lbs. of force retracts stops along the bottom of the window. The bottom of the window then can be pulled inward with minimal force. The top of the window falls free of the frame and the entire window drops into the cabin. It is important to note the window can not be pushed outward, it must pulled inside, and is so noted in the instructions. Then occupants are unrestrained from exiting the aircraft. The operator's manual displays a labeled picture of the exits and handles as seen in the Appendix, Figure 6. Emergency procedures in chapter 9 are simple and adequate.

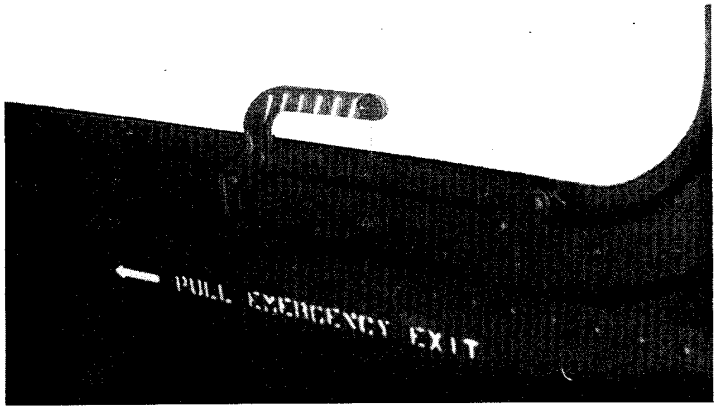


Figure 5. UH-1 cabin emergency egress handles.

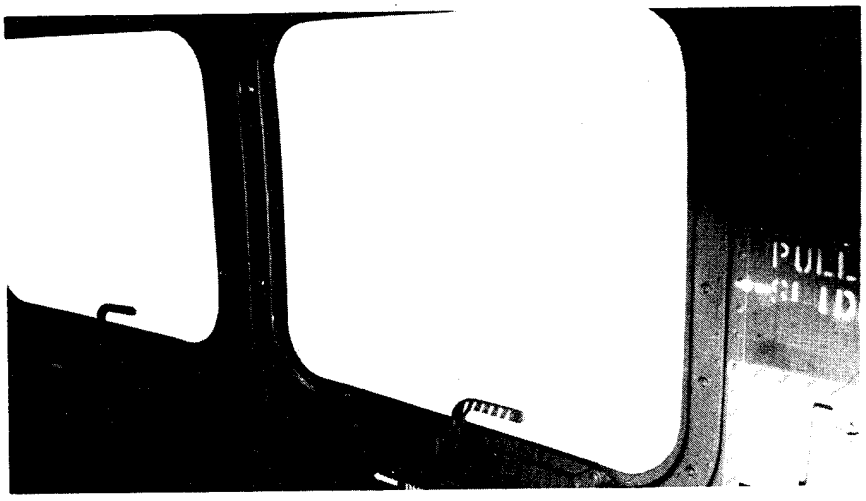


Figure 6. UH-1 cabin emergency exits.

UH-60 Black Hawk

Cockpit --- Emergency release handles are located on the inside frame of each cockpit door. They allow the cockpit doors to be jettisoned in case of an emergency. The handles are yellow and are surrounded with ample instructions as shown in Figures 7 through 9. Pulling the emergency handle with 40-45 lbs. of force turns a cam inside the door allowing the door to be separated from the hinge at the mounting points. The operator's manual emergency procedure states the door then may be jettisoned by kicking the lower forward corner. This procedure works; however, on the doors tested, it required *substantial* force to dislodge the door from the hinge. Once the connection is broken, the door falls away from the aircraft. As with the UH-1, the egress is hampered substantially if the protective armor plating has been moved forward. However, unlike the UH-1, the plating on the UH-60 can be moved rearward with only one hand. The weak link of this procedure is the process of kicking the door away from the hinge.

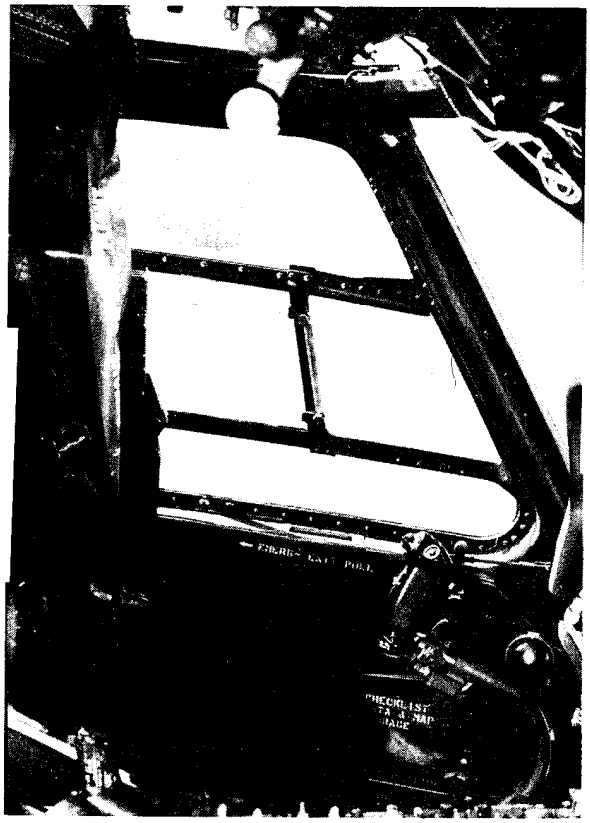


Figure 7. UH-60 cockpit area.

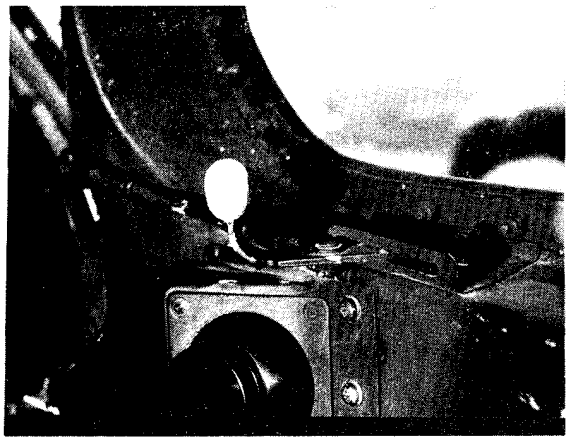


Figure 8. UH-60 cockpit emergency egress handles.

Cabin --- The egress from the cabin area of a UH-60 is unique and poses no

physical difficulties, but it could be confusing under certain circumstances. First under normal egress procedures, passengers seated in the aft area are unable to reach the handle of the cabin door when the system of seating four across the center is used. The doors must be opened by someone sitting in the forward area or from the outside. Second, there is only one cabin door window jettison handle on each cabin door, and they are in different locations on each side. The handles are located under the front window on the left cabin door and under the rear handle on the right side door as shown in Figures 10 and 11. In the Appendix, the cabin's emergency exits can be seen in Figure 12. The locations make it very difficult for passengers in the front area to operate the right side emergency exit, and for passengers in the rear area to jettison the cabin windows on the left side. The direction of handle pull on each side also is different. On the left side the handle is pulled aft and the handle on the right is pulled forward as explained under emergency exits in the operator's manual. On the positive side of the egress procedure, it takes only approximately 10 lbs. of force to operate the handles and then the windows easily are pushed outward. Pulling the handle releases both the front and the rear cabin door windows on that side.

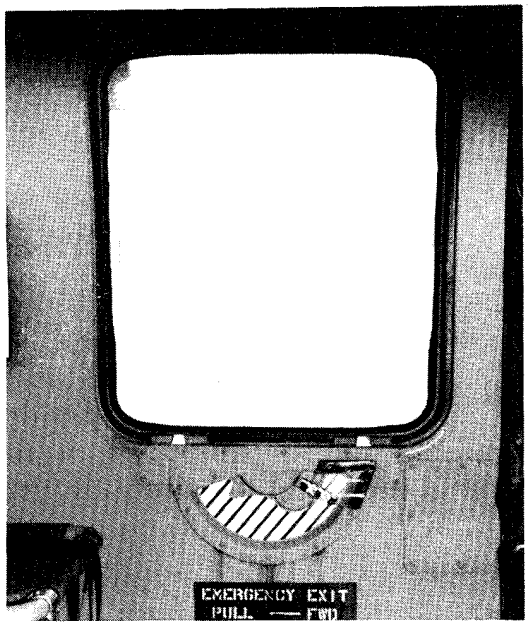


Figure 10. UH-60 cabin area.

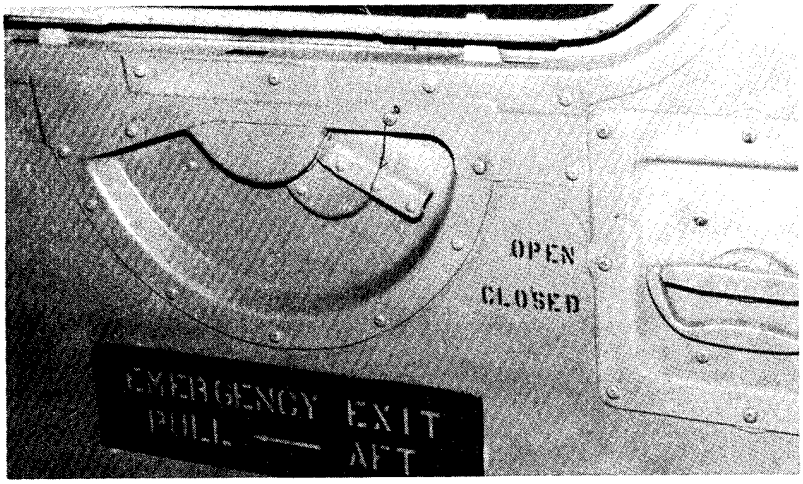
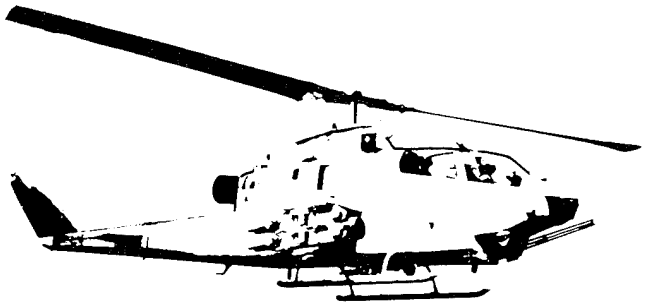


Figure 11. UH-60 cabin emergency egress handles.



AH-1 Cobra

Cockpit only --- The Cobra contains a canopy jettison system that can be operated from either the pilot's rear seat or the copilot/gunner's, (CPG) front seat. The arming/firing mechanisms are located near the instrument panel and have operating instructions on them as shown in Figures 13 through 17. These firing mechanisms are operated by turning the handle 90 degrees counterclockwise with a torque of 6-12 inch-pounds. This maneuver arms

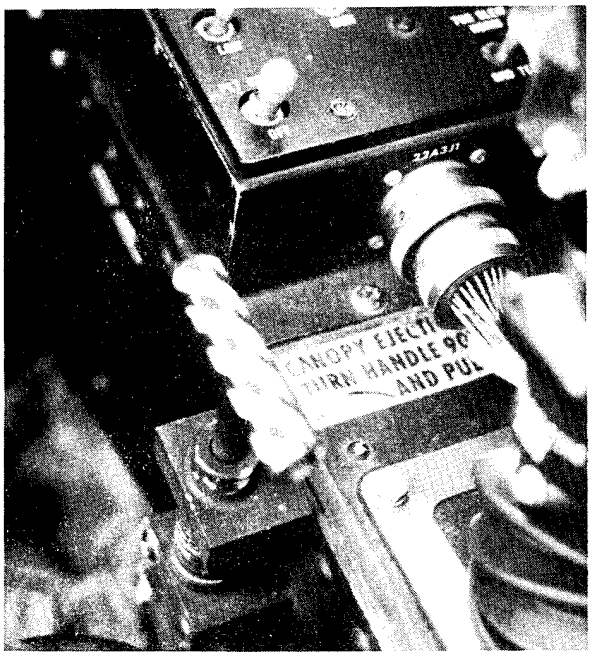


Figure 14. AH-1 copilot/gunner emergency egress handle.

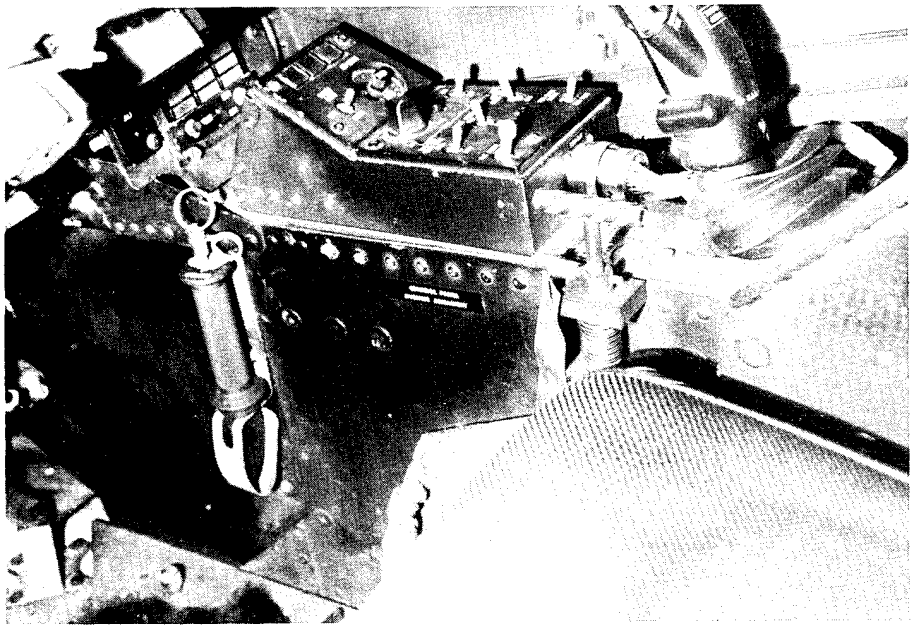


Figure 13. AH-1 copilot/gunner cockpit area.

the assembly. The operator then pulls the handle with 20-35 lbs. of tension, firing the primer and causing the cutting assembly to be detonated. The process is completed by the detonation cord, that burns around the periphery of all the side panels, severing them from the fuselage. This system is explained in chapter 2, section II of the operator's manual, but there are no emergency procedure steps outlined in chapter 9. Once the canopy is jettisoned, there is a clear access area for the pilots to egress.

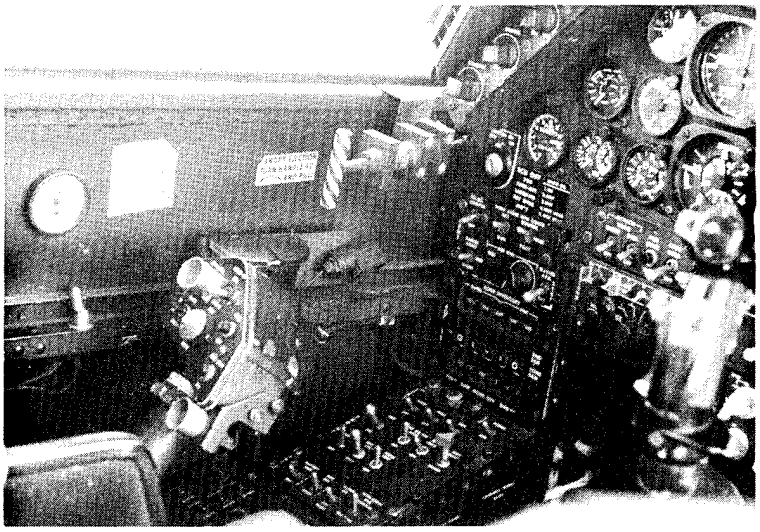


Figure 15. AH-1 pilot cockpit area.

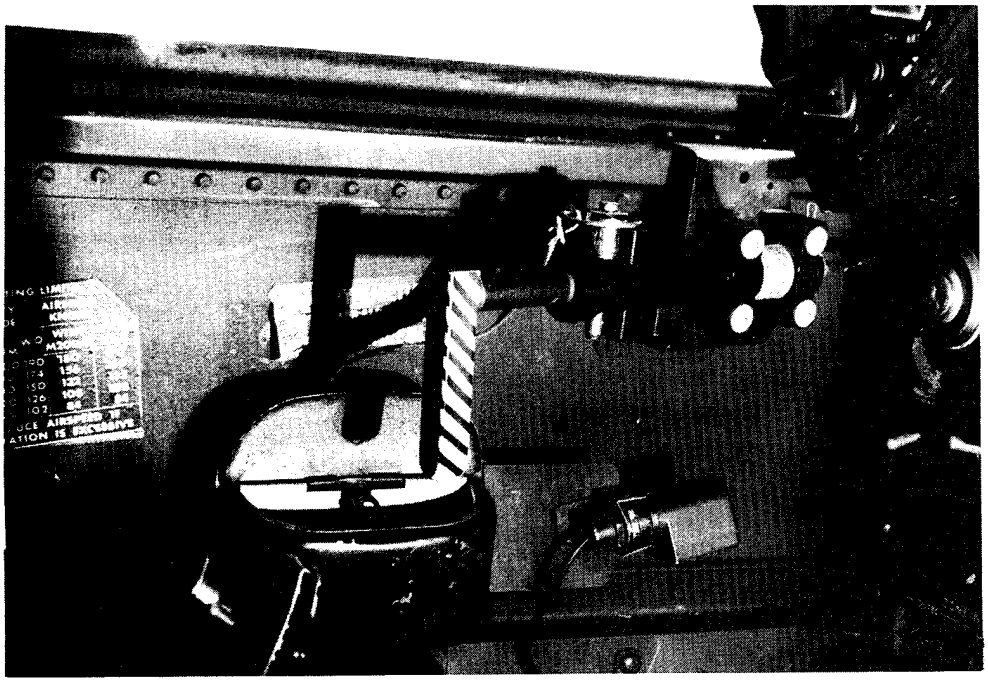


Figure 16. AH-1 pilot emergency egress handle.

AH-64 Apache

Cockpit only --- The Apache also has a canopy jettison system that expels the four acrylic panels on the sides of the pilot and CPG stations. The Apache however, has three canopy jettison handles. One is on the upper left corner of the pilot's instrument panel. A second is at the upper left corner of the CPG panel. And the third is the external ground crew handle located on the front of the aircraft, under a quick-release panel directly forward of the CPG's windshield as shown in Figures 18 through 23. Like the Cobra, the Apache system is based on an arming/ firing handle, a primer/initiator, and a detonation cord around the periphery of the side panels. The operating instructions again are directly on the jettison handles. The system is armed by rotating the canopy jettison handle 90 degrees left or right, which then uncovers the word ARMED on both sides of the handle. The system then is activated by pushing the jettison handle in, detonating the primer/initiator within the handle. The system is explained very well in chapter 2 of the operator's manual. The emergency egress procedures are in chapter 9.

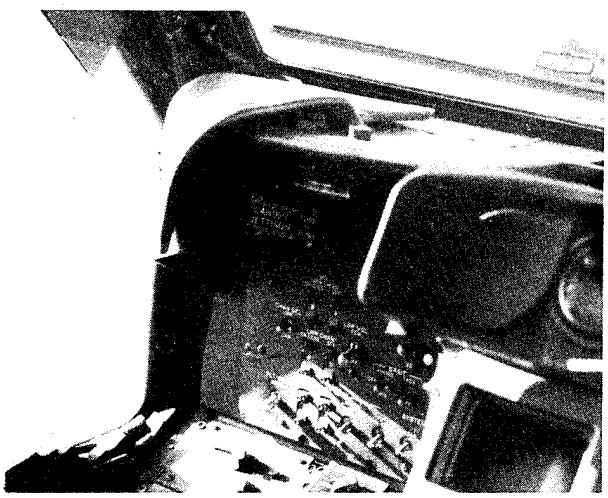


Figure 18. AH-64 copilot/gunner cockpit area.

Figure 19. AH-64 copilot/gunner emergency egress handle.

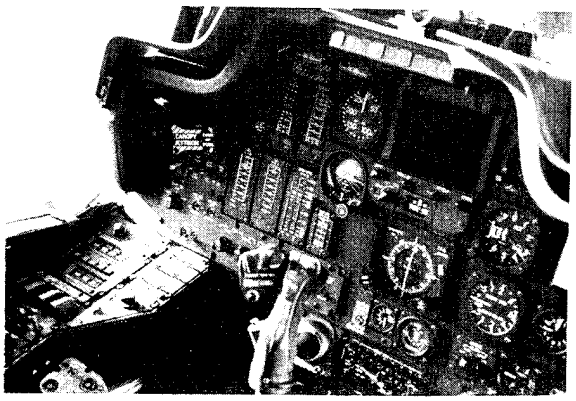


Figure 20. AH-64 pilot cockpit area.

Figure 21. AH-64 pilot emergency egress handle.

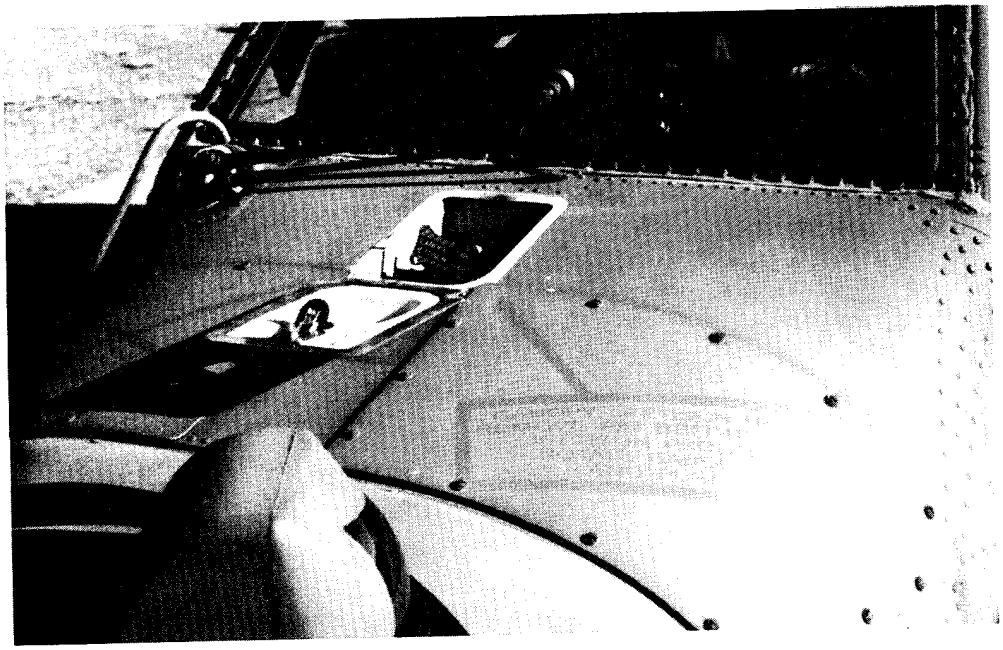
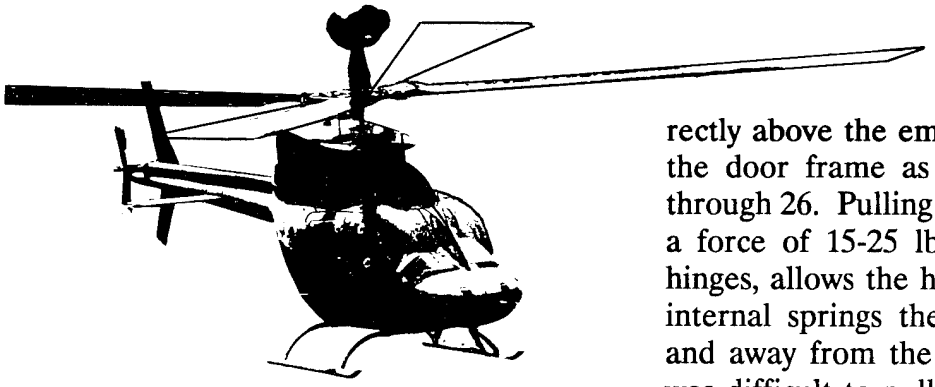


Figure 22. AH-64 ground crew emergency egress handle.



OH-58 Kiowa

Cockpit --- The cockpit door emergency jettison handles are located on the inside of the door frames just above the upper hinges. The yellow handles are directly above the emergency exit labels on the door frame as shown in Figures 24 through 26. Pulling aft on the handle with a force of 15-25 lbs. pulls pins on both hinges, allows the hinges to separate, and internal springs then push the door out and away from the aircraft. The handle was difficult to pull aft if there was pressure on the handle towards the center of the cockpit while pulling. We found the end of a mounting bolt restricted the rotation of this lever. This easily was compensated for by applying slight outward pressure on the handle while pulling aft. The armor plating opens easily and quickly

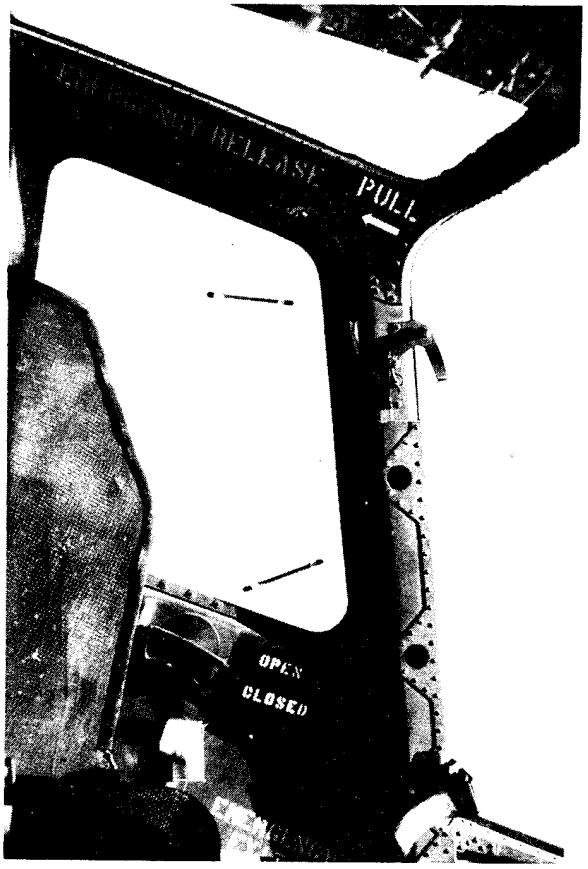


Figure 24. OH-58 cockpit area.

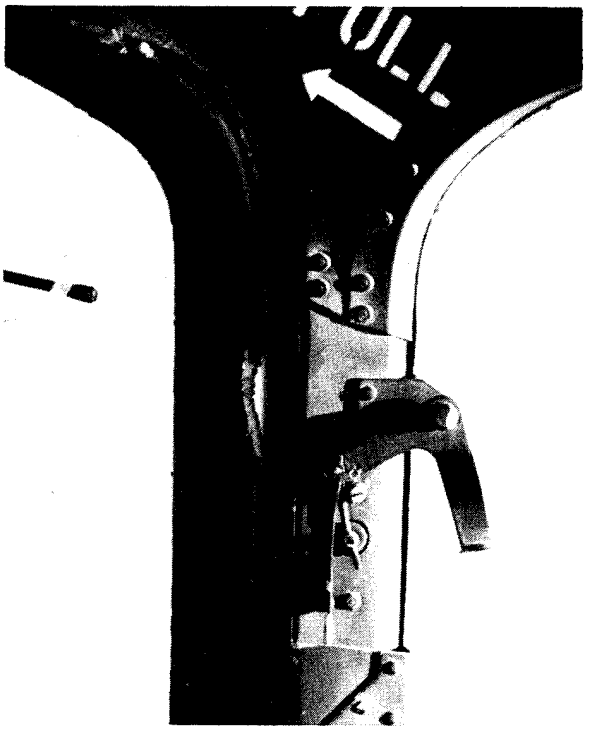


Figure 25. OH-58 cockpit emergency egress handles.

with the outside hand and is not an obstacle while exiting the aircraft. However, if for some reason, i.e., hard landing, the armor should become stuck, the egress area would be reduced substantially. The operator's manual has good figures of the emergency jettison handles and has concise and simple operating instructions in chapter 9. Also, it is important to note in this aircraft the cockpit emergency handles are in a good location to be utilized as hand rests. The operator's manual has a warning in chapter 2 that this may result in inadvertent jettisoning of cockpit doors.

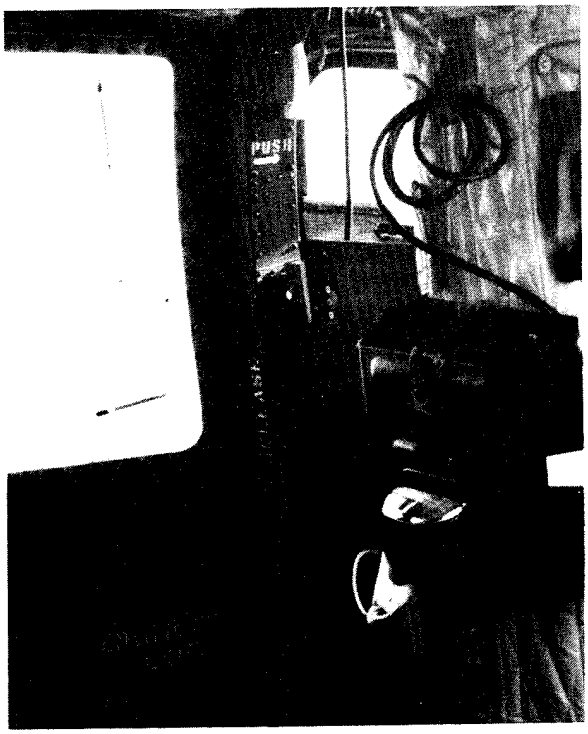


Figure 26. OH-58 cabin area.

Cabin --- The cabin emergency jettison handles are located on the aircraft frame between the cockpit and cabin doors. The handles are yellow and black striped with instructions on the frame immediately below them as shown in Figures 26 through 28. They operate in a similar fashion and equally as effectively as the cockpit jettison system. The differences is that the cabin handle must be pushed forward and the force required is 25-30 lbs. The door then is easily popped off with the assistance of springs, opening a large egress area. It should be pointed out that if the passenger in the rear is restricted by their inertial reel seat restraint, they may have difficulty reaching the emergency handle because of the distance.

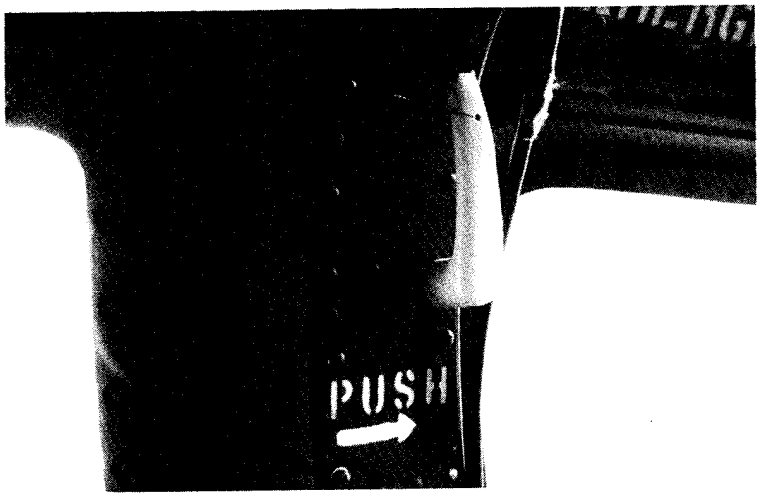


Figure 27. OH-58 cabin emergency egress handles.

CH-47 Chinook

Cockpit --- Inside handles for the cockpit door emergency exit are located directly above the cockpit doors. The handles are yellow and black striped with operating instructions on them as shown in Figures 29 and 30. The handles either can be pushed up or pulled down to disengage the entire door from the frame. The door then falls out, top first. There are no warnings in the operator's manual about using this handle as a hand rest, but care must be taken to prevent accidental jettisoning. The system also may be activated by outside emergency handles located directly below and aft of the cockpit doors. To operate, the handle first must be extended from the aircraft, then turned while pushing in the trigger button. The instructions for this procedure are painted on the side of the aircraft. When this technique is used, the bottom of the door comes out first. The person operating the exterior handle should be aware of, and avoid the falling door. The force required to turn either handle is between 35 and 40 lbs. With the door off, there is ample room to exit the aircraft. The operator's manual contains ample pictures of the emergency escapes in chapter 9 as shown in Figure 31.

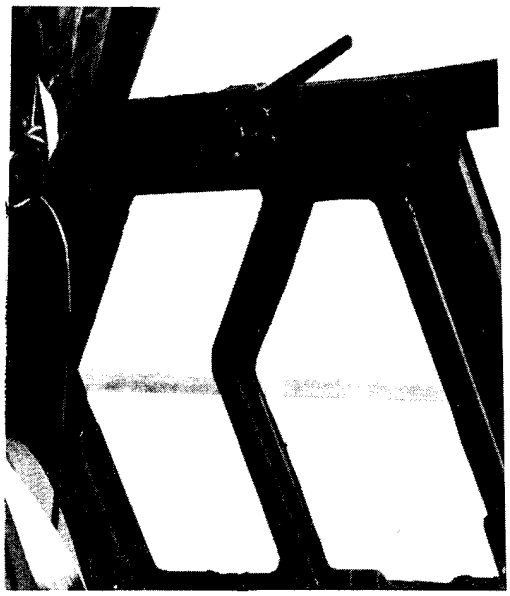


Figure 29. CH-47 cockpit area.

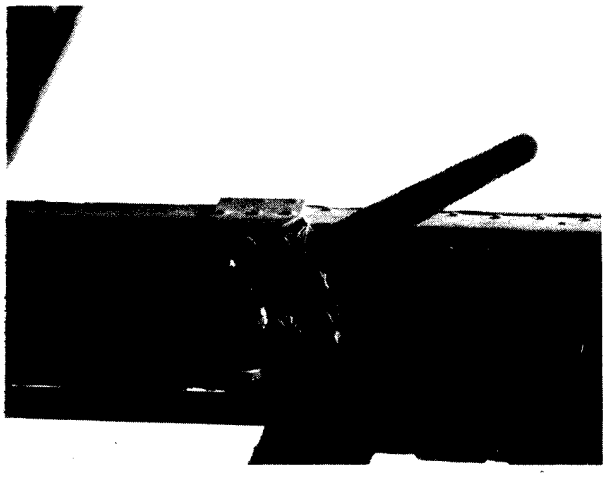


Figure 30. CH-47 cockpit emergency egress handles.

Cabin --- Emergency egress from the cargo area of a Chinook is accomplished by jettisoning the windows, the

emergency exit on the ramp shell, the shell itself, or exiting through the cargo hook viewing hatch. The windows are jettisoned by pulling a yellow strap hanging from each window as shown in Figure 32. The strap is connected to a seal that runs completely around the window. Pulling the strap away breaks the entire seal and the window then can be pushed out. In addition to the window, a square panel around the window comes out with the front exits on either side, and the exit located on the ramp shell. Adequate instructions for operating these emergency exits are located near the exits and in chapter 9 of the operator's manual as shown in Figures 34 and 35.

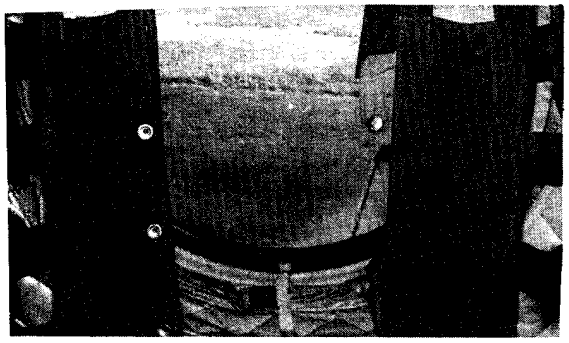


Figure 32. CH-47 cabin area emergency egress window straps.

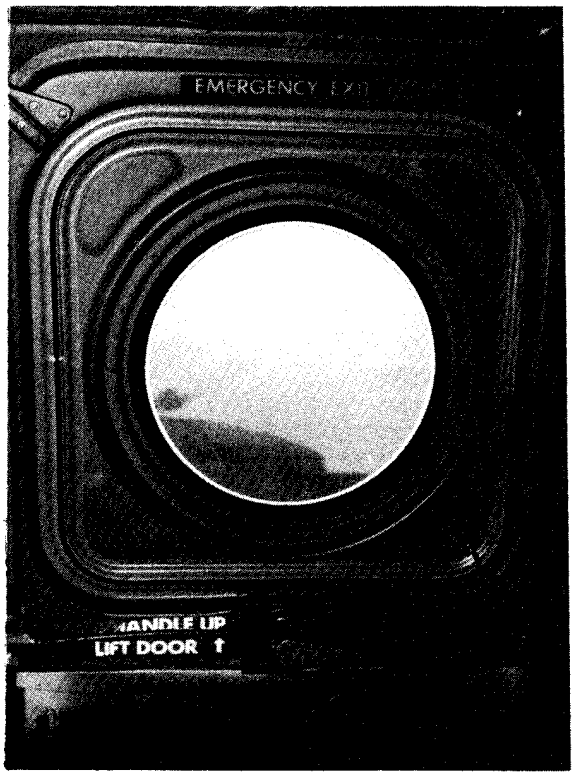


Figure 31. CH-47 cabin area emergency egress door strap.

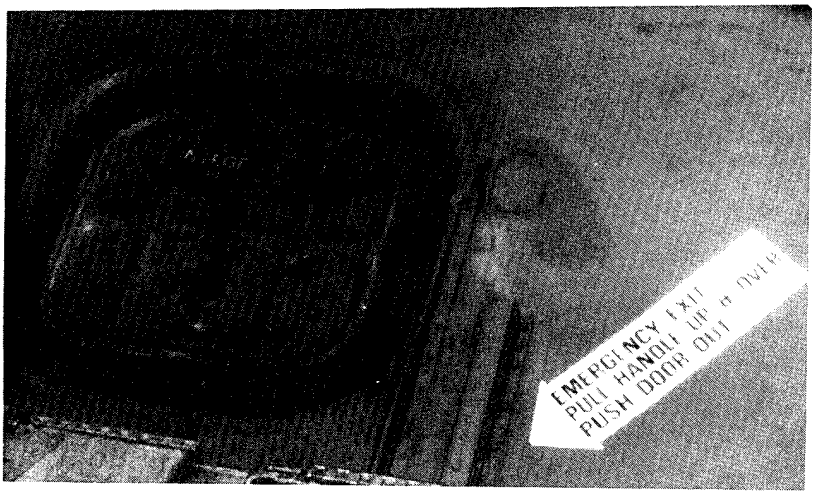


Figure 33. CH-47 cabin area emergency egress ramp.

Conclusions

There is no specific standardized method to describe emergency egress procedures in U.S. Army helicopters. The procedures are covered in chapters 2 and 9 of each operator's manual, but not necessarily in the same sections in every manual. Each aircraft has a slightly different mechanism or technique for initiating the egress process. These different procedures are displayed in or on the aircraft in strategic locations to facilitate proper usage. It is critical that pilots and passengers familiarize themselves with each aircraft. A crew and passenger briefing is required. Each helicopter's operator's manual has a preflight check list, including the emergency egress procedures.

The standard aircraft exit restrictions from the cockpit are: the collective (left side only), the cyclic, and protective armor plating if installed. Under normal egress procedures, the collective and cyclic are not very restrictive, the UH-60 collective is even collapsible. However, any time the protective armor plating is used and is difficult to retract, there is the potential for a substantial reduction in the size of the egress opening. The UH-1 Huey is an example.

During any emergency, helmet visors should be down; this is important especially during an emergency egress.

Pilots and crew members should feel safe and confident they will be able to egress from an aircraft in case of a mishap. However, they need to remember that knowledge of the proper egress procedures for the specific aircraft being flown is essential for an expeditious egress. Also, it should be noted that an egress or survival knife always can be used to exit an aircraft as a last resort.

References

Operator's Manual, Army Model UH-1H/V Helicopters, TM 55-1520-210-10, 15 Feb 88.

Operator's Manual, Army Model UH-60A/L Helicopters, TM 1-1520-237-10, 31 Aug 94.

Operator's manual, Army model AH-1S helicopters, TM 55-1520-236-10, 11 Jan 80.

Operator's manual, Army model AH-64A helicopters, TM 55-1520-238-10, 28 Jun 84.

Operator's manual, Army model OH-58A/C helicopters, TM 55-1520-228-10, 17 Jan 89.

Operator's manual, Army model CH-47 helicopters, TM 55-1520-240-10, 30 Apr 92.

Post, T. J., and Kershner, R. L. 1979. An evaluation of a new format for presenting ejection information in a NATOPS manual (Contract No. N00014-77-C-0312). Falls Church, VA: Biotechnology, Inc.

Lee, C. J. 1990. Standardization of NATOPS emergency egress procedures. Proceedings of the 28th Annual Symposium SAFE Association, Newhall, CA. pp 196.

Appendix A.
Diagrams.

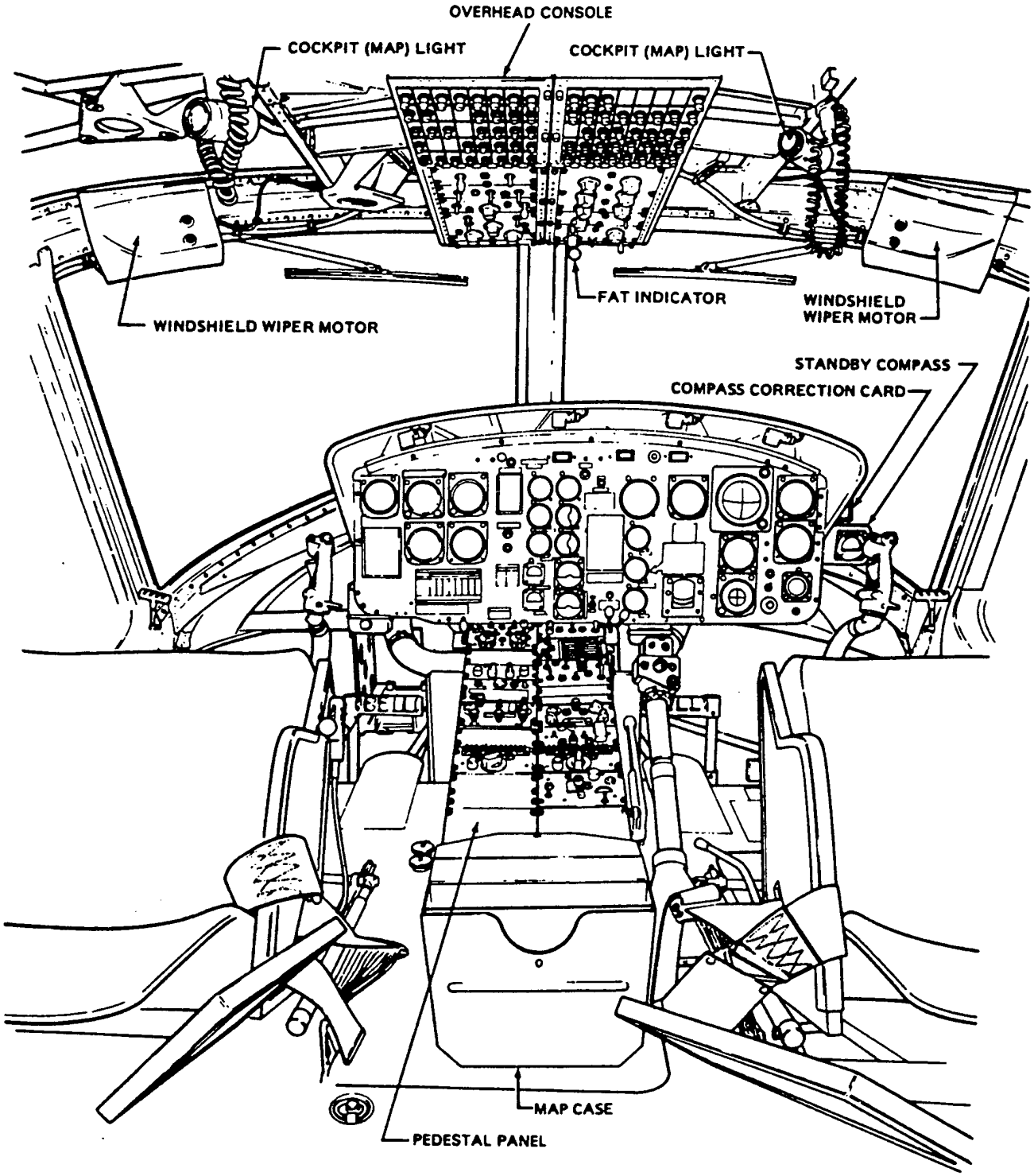
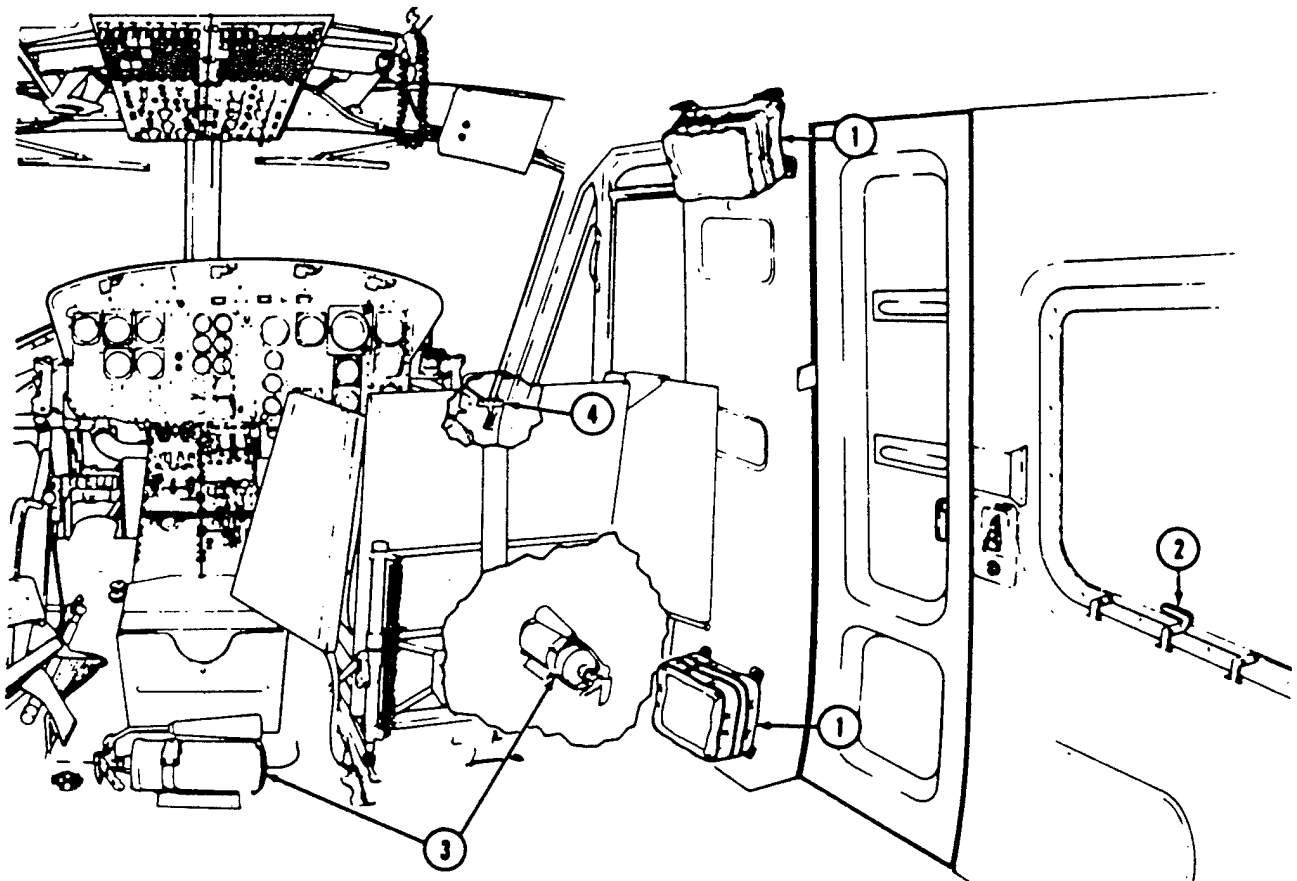
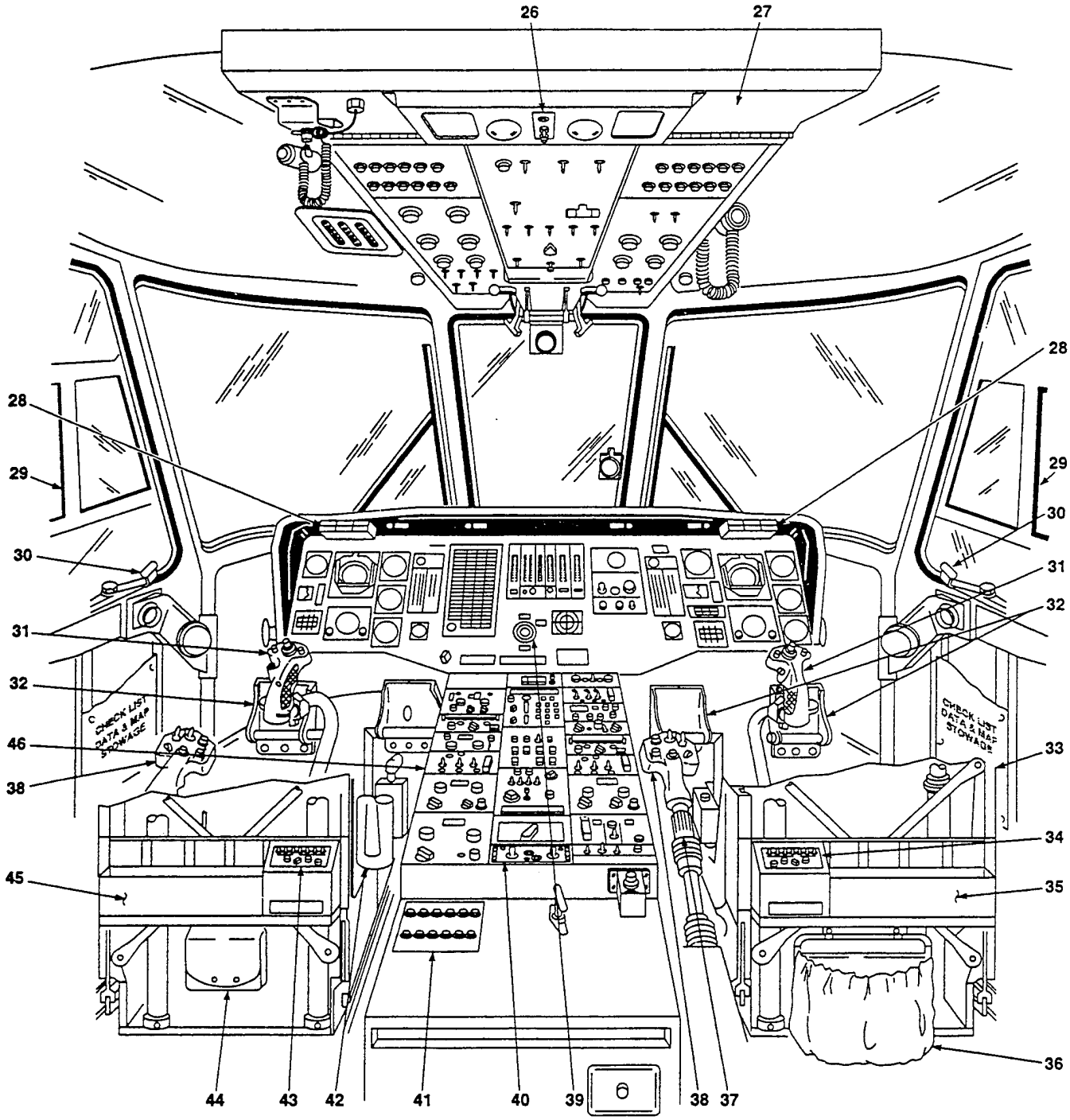


Figure 3. UH-1 cockpit diagram.



1. First aid kit (4) (Left side not shown)
2. Cabin door window emergency release handle (Left side not shown)
3. Fire extinguisher (1)
4. Crew door jettison handle (Left side not shown)

Figure 4. UH-1 cabin area.



26. COCKPIT FLOODLIGHT CONTROL
27. UPPER CONSOLE
28. MASTER WARNING PANEL
29. SLIDING WINDOW
30. COCKPIT DOOR EMERGENCY RELEASE
31. CYCLIC STICK
32. DIRECTIONAL CONTROL PEDALS
33. PILOT'S SEAT
34. CREW CHIEF / GUNNER ICS CONTROL PANEL
35. CREW CHIEF AMMUNITION / GRENADE STOWAGE COMPARTMENT
36. STOWAGE BAG
37. COLLECTIVE STICK FRICTION CONTROL
38. COLLECTIVE STICK GRIP
39. ENGINE IGNITION KEYLOCK
40. LOWER CONSOLE
41. BATTERY / BATTERY UTILITY BUS CIRCUIT BREAKER PANEL
42. FIRE EXTINGUISHER
43. GUNNER'S ICS CONTROL PANEL
44. FIRST AID KIT
45. GUNNER'S AMMUNITION / GRENADE
46. COPILOT'S SIDE LOWER CONSOLE

Figure 9. UH-60 cockpit diagram.

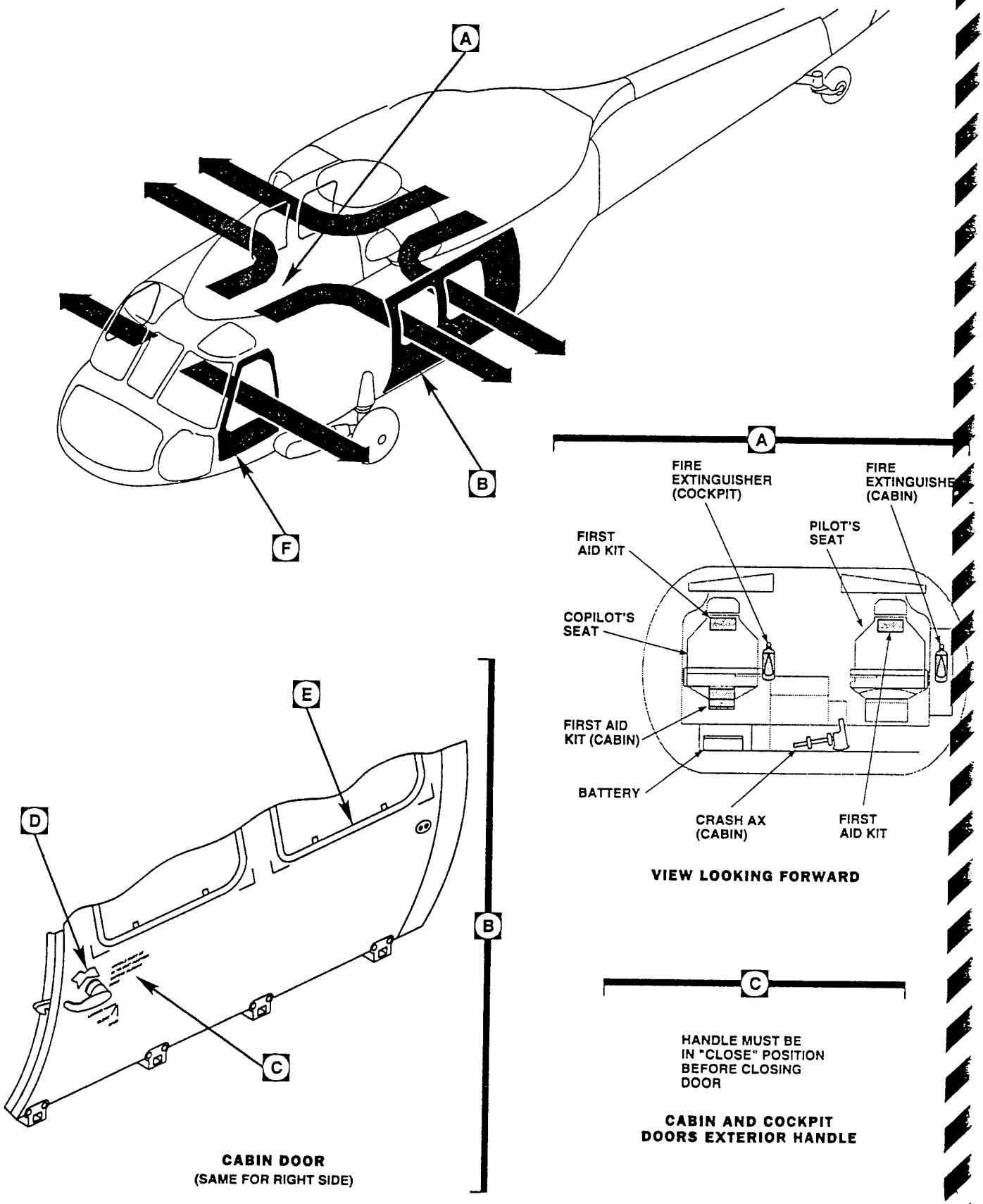


Figure 12. UH-60 cabin emergency exits.

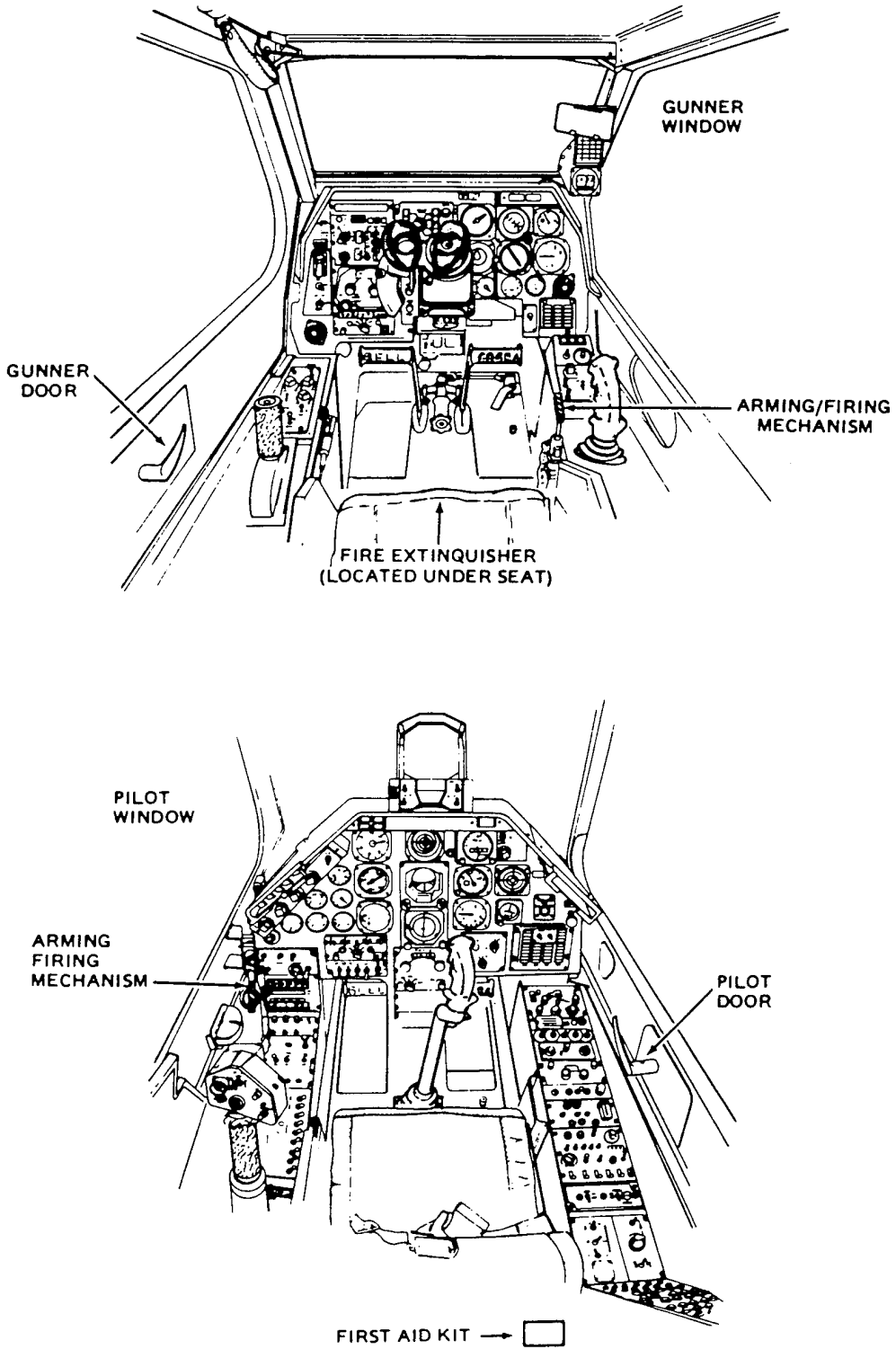


Figure 17. AH-1 cockpit emergency exits.

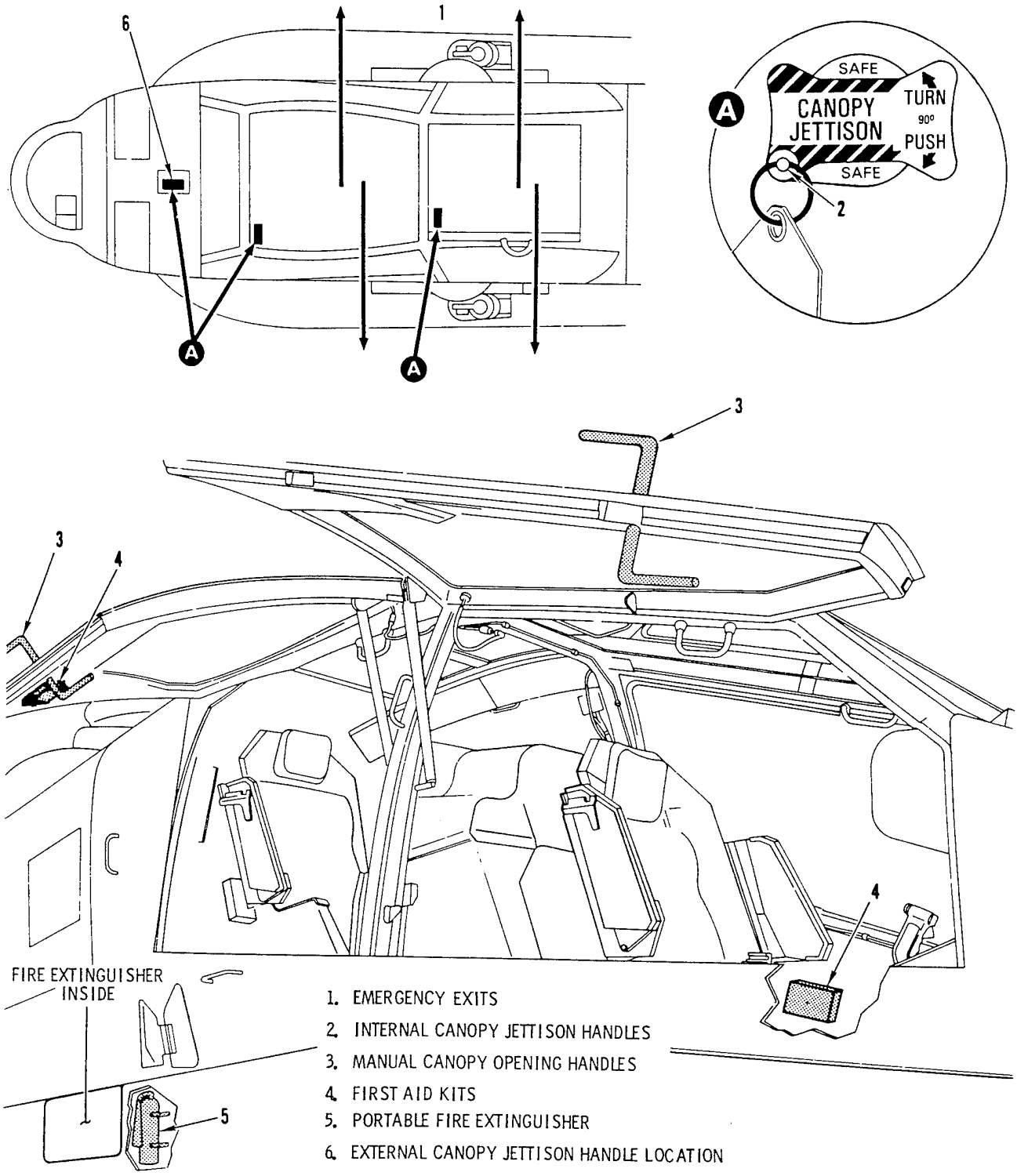


Figure 23. AH-64 ground crew emergency egress handles.

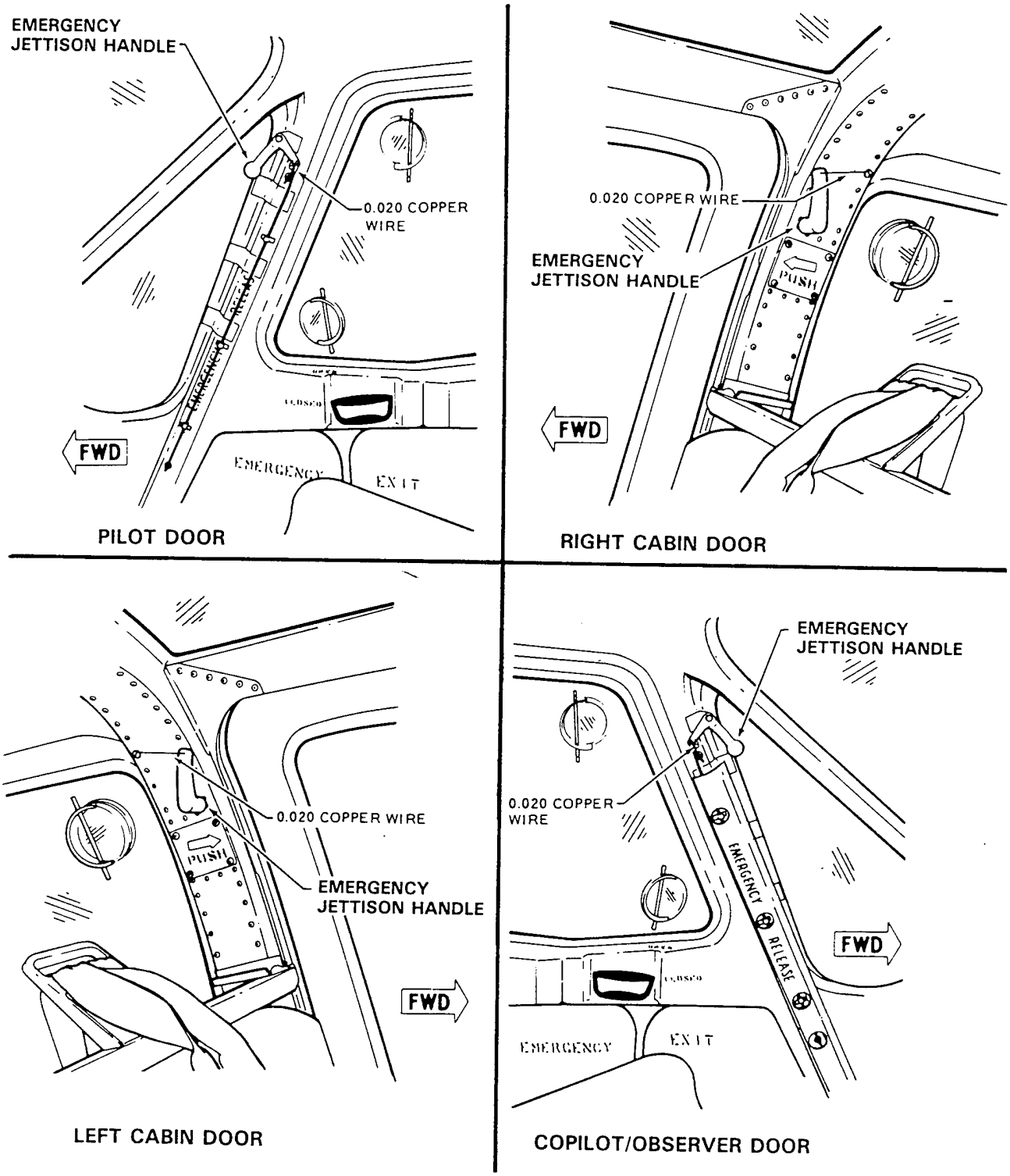


Figure 28. OH-58 cabin emergency egress handles.

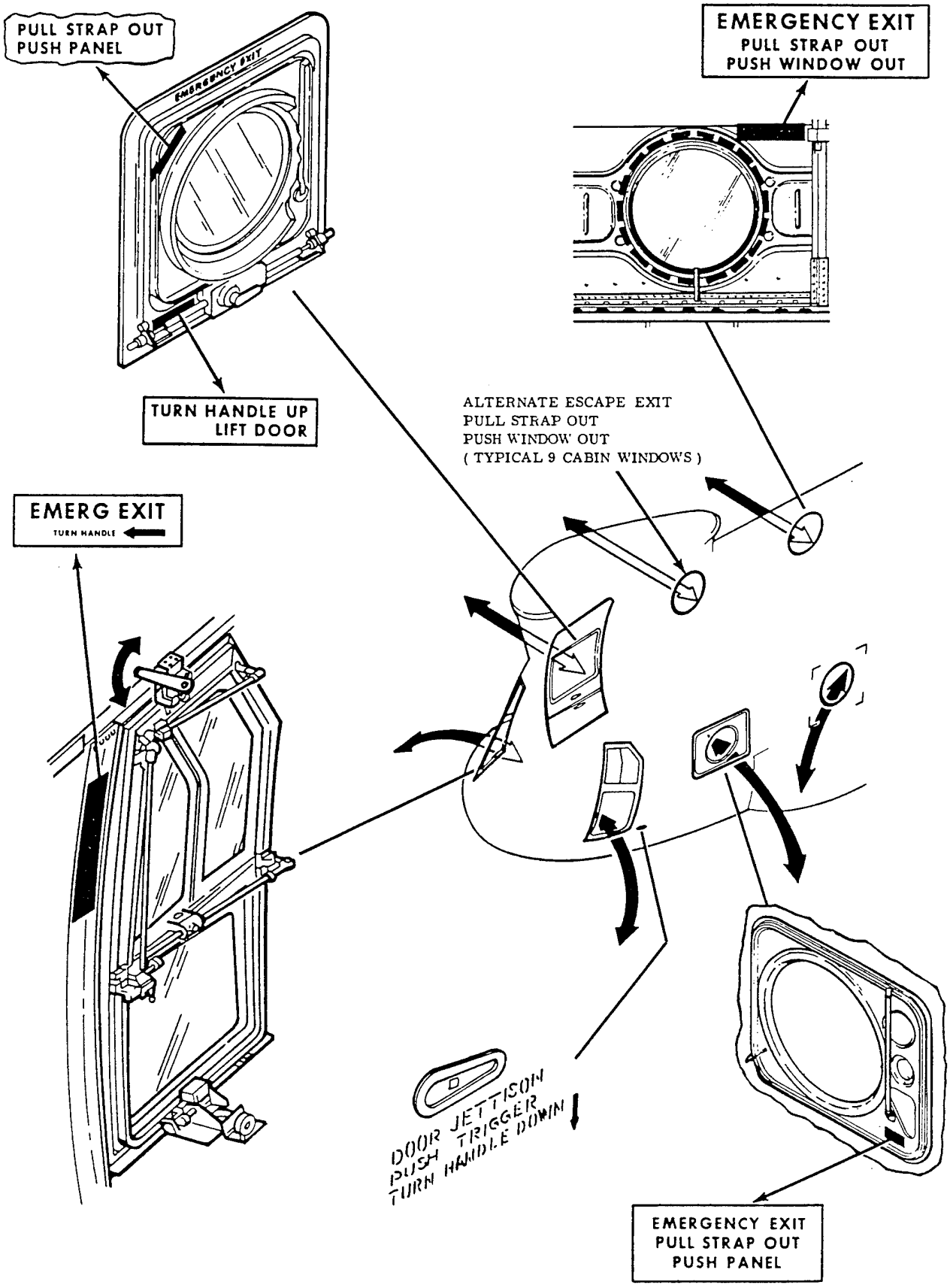


Figure 34. CH-47 cockpit and cabin emergency exits.

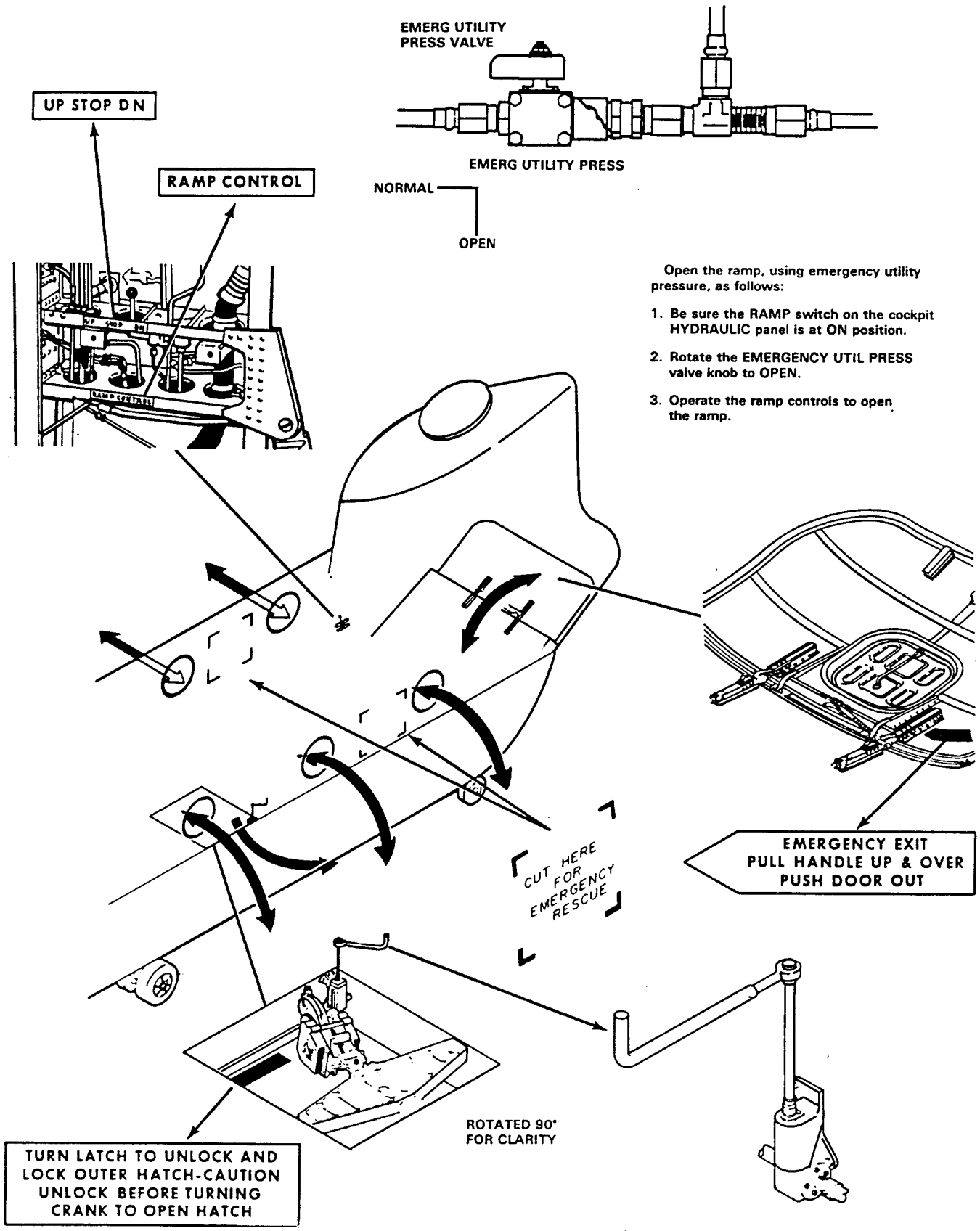


Figure 35. CH-47 cabin area and ramp emergency exits.

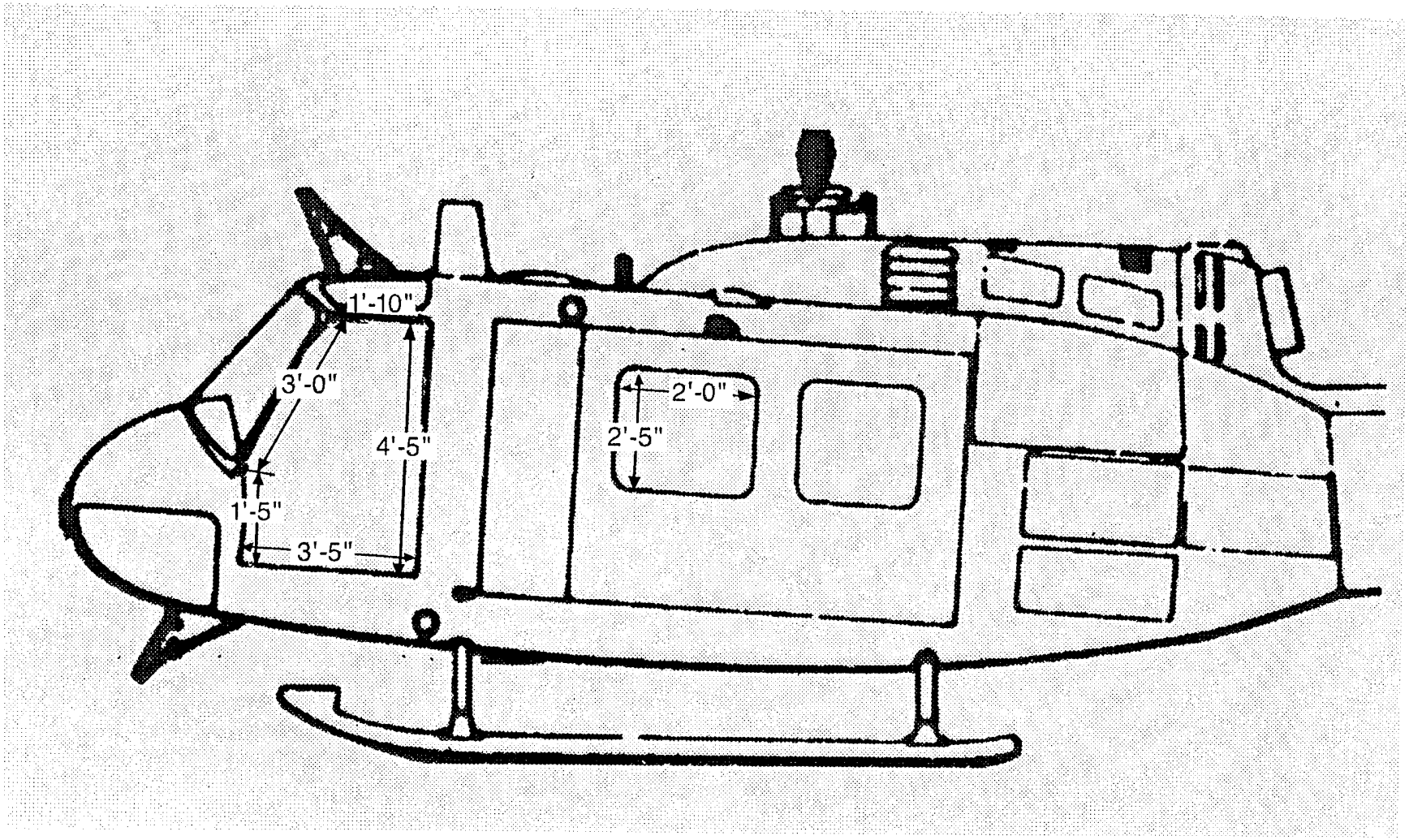


Figure 36. UH-1 Huey schematic showing dimensions of egress areas.

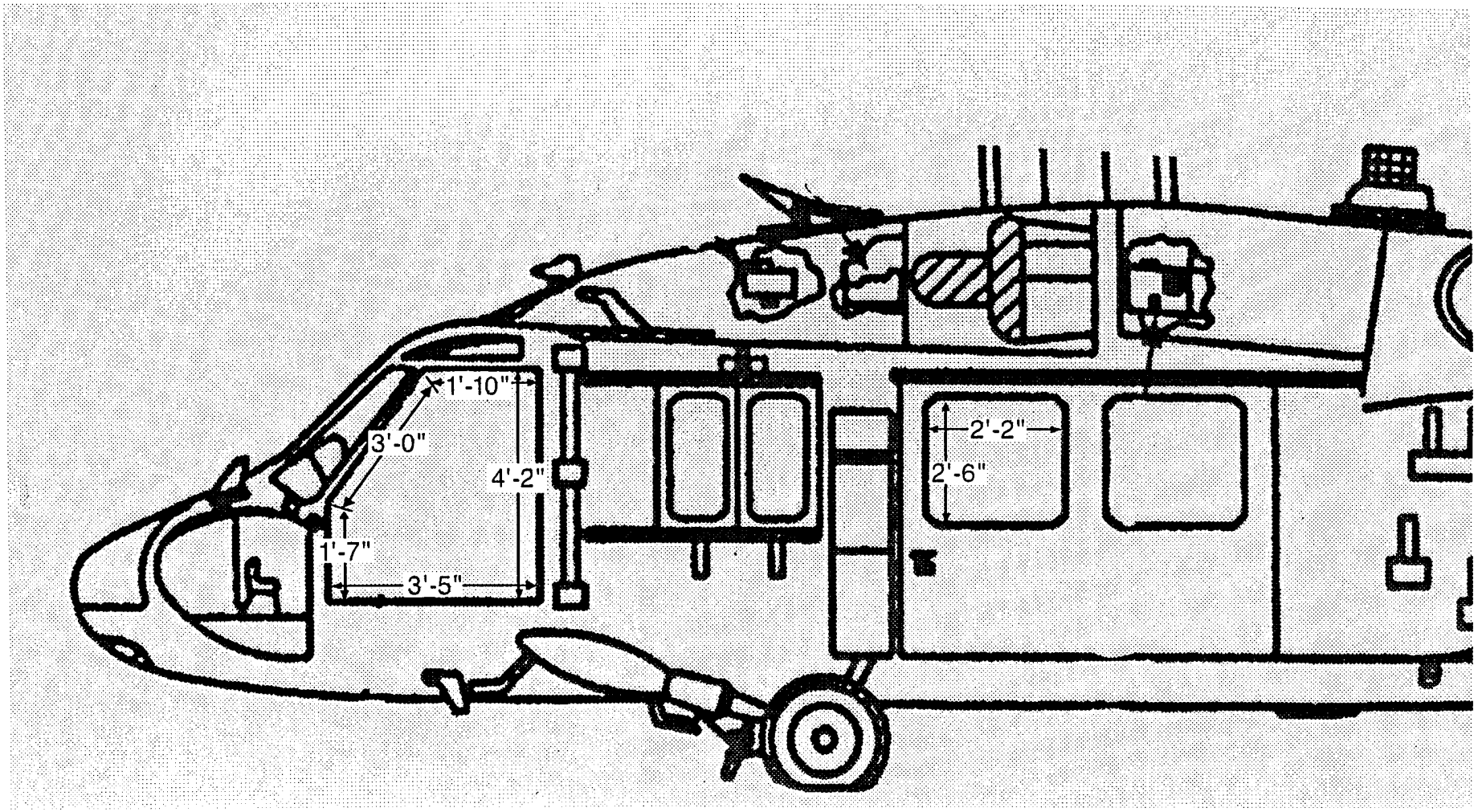


Figure 37. UH-60 Black Hawk schematic showing dimensions of egress areas.

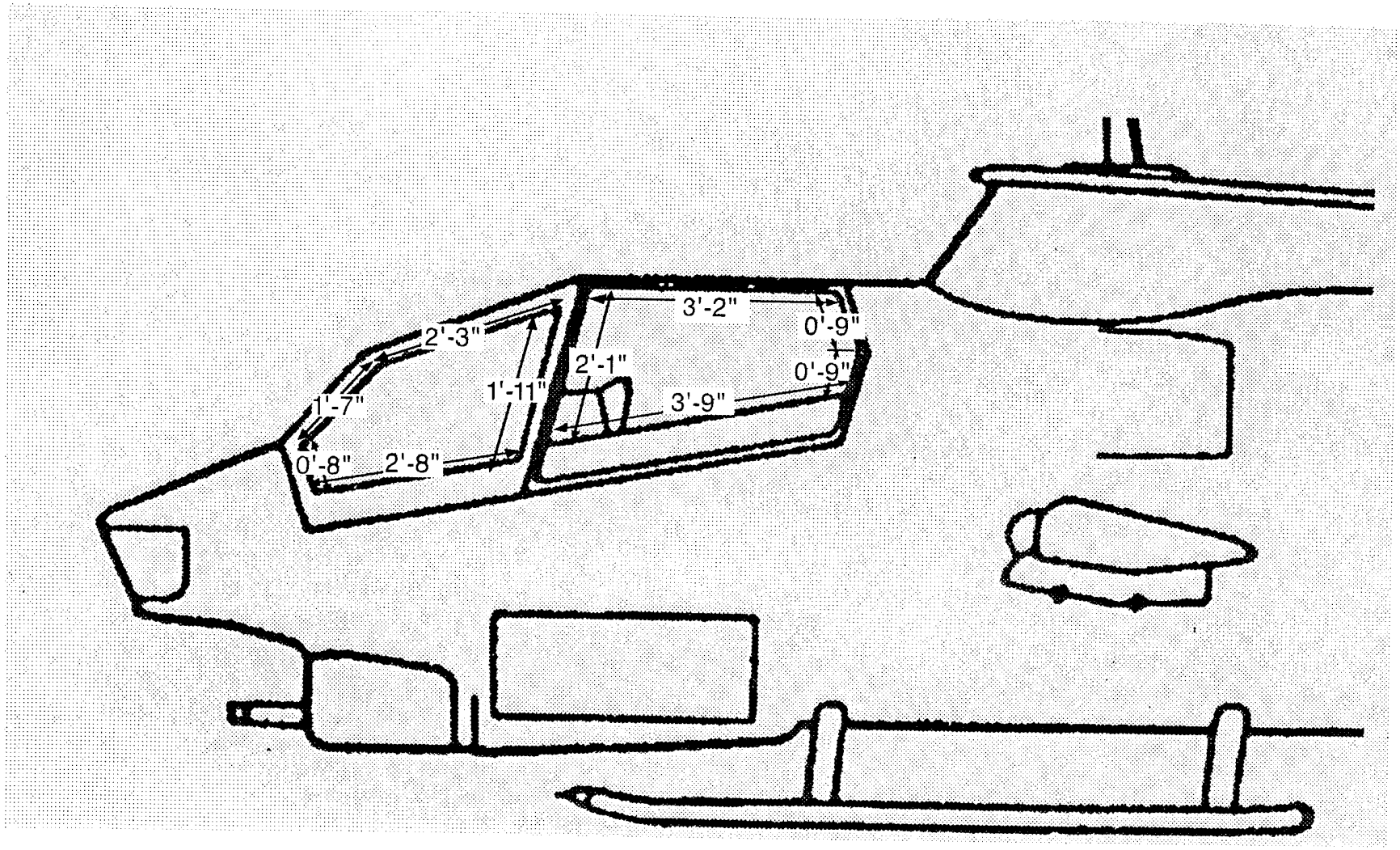


Figure 38. AH-1 Cobra schematic showing dimensions of egress areas.

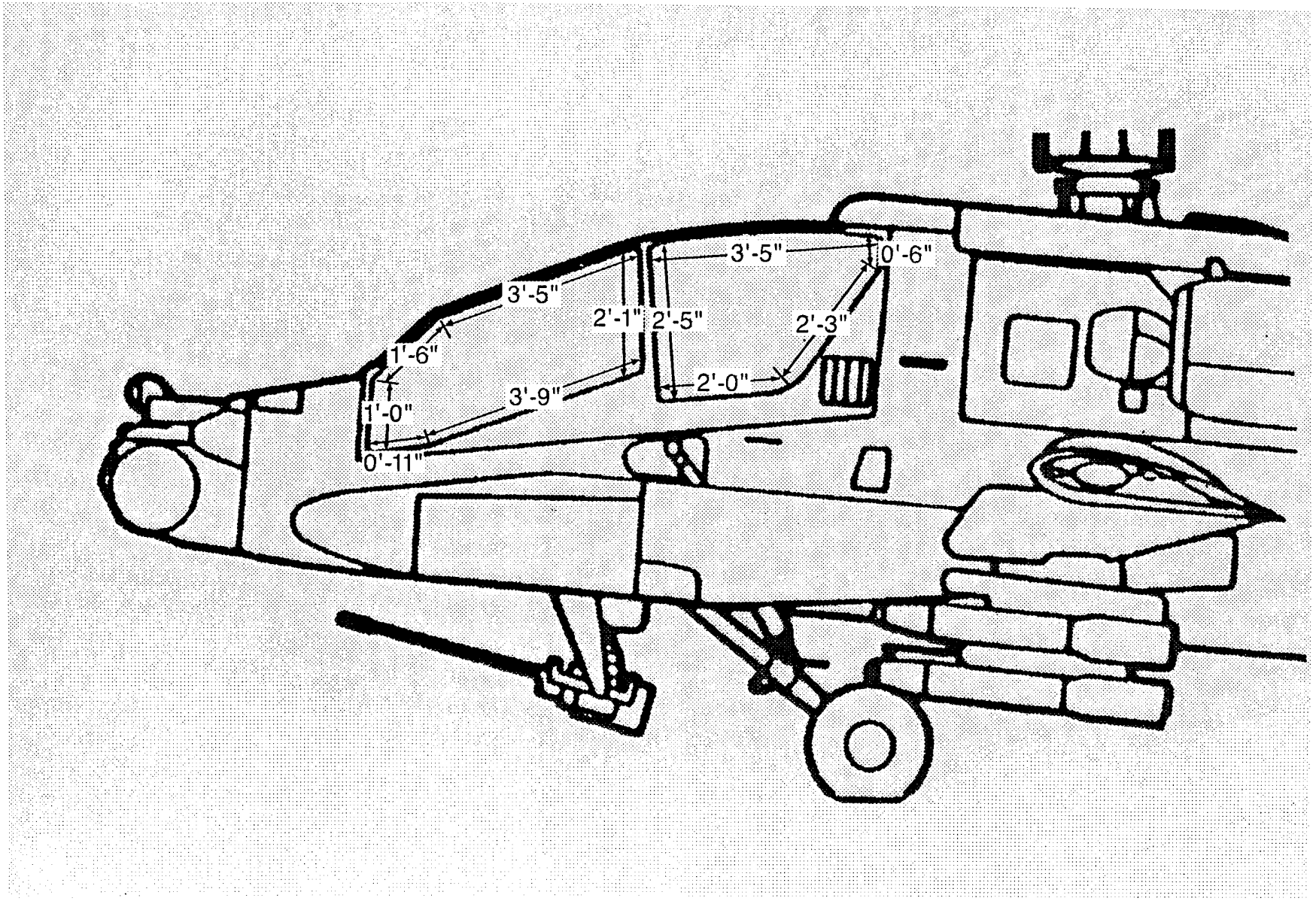


Figure 39. AH-64 Apache schematic showing dimensions of egress areas.

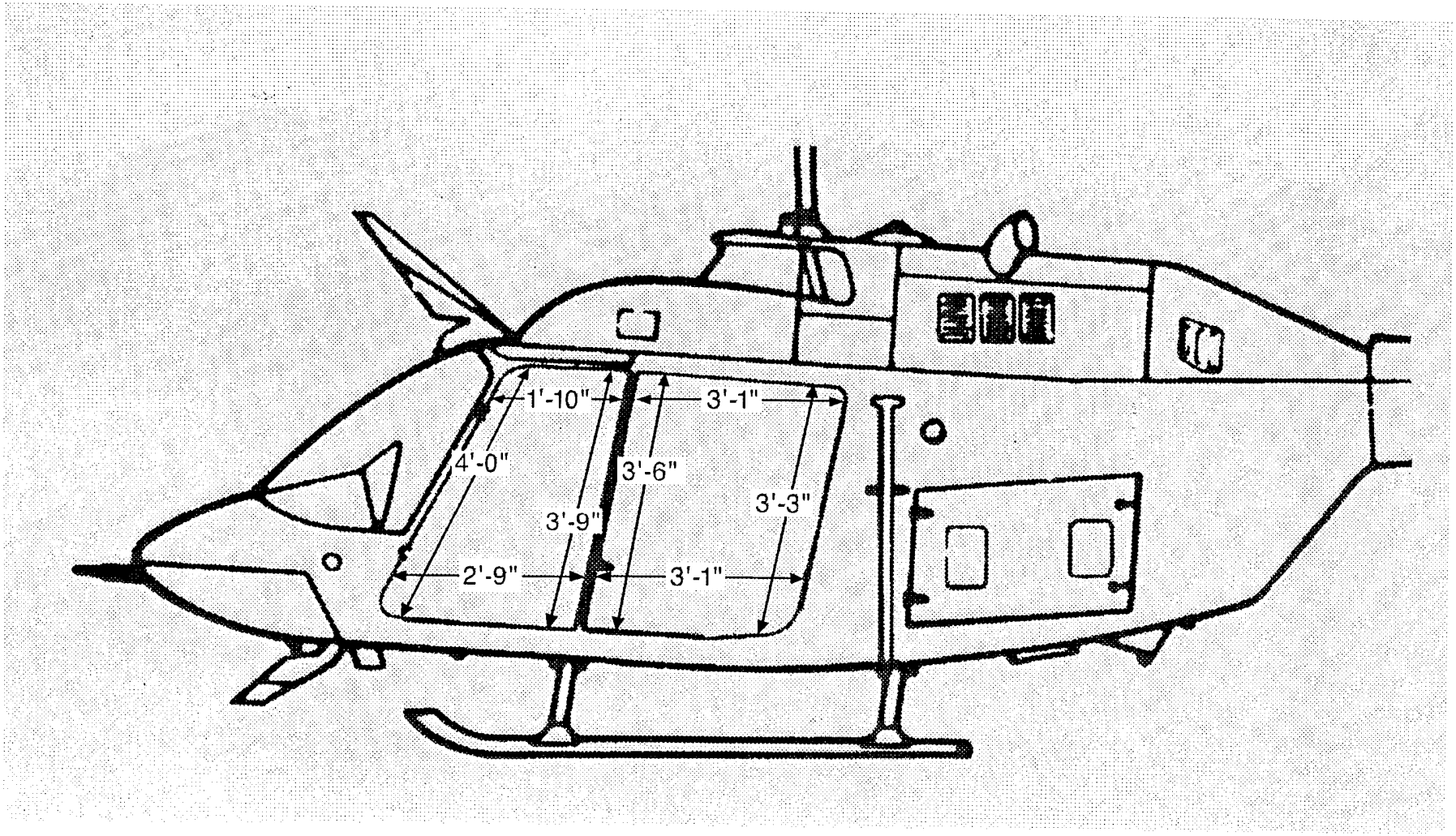


Figure 40. OH-58 Kiowa schematic showing dimensions of egress areas.

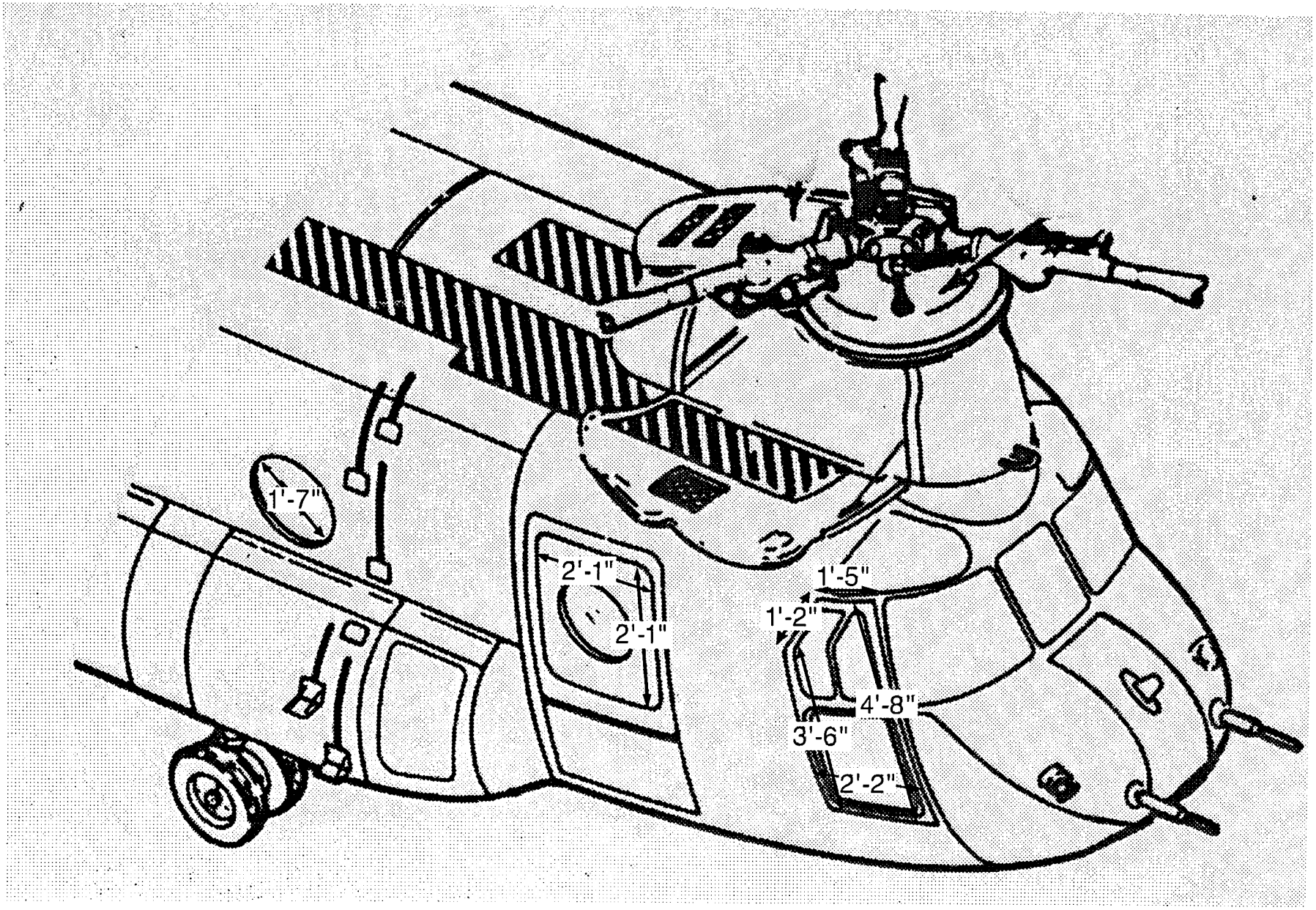


Figure 41. CH-47 Chinook schematic showing dimensions of egress areas.

Initial distribution

Commander, U.S. Army Natick Research, Development and Engineering Center
ATTN: SATNC-MIL (Documents Librarian)
Natick, MA 01760-5040

Chairman
National Transportation Safety Board
800 Independence Avenue, S.W.
Washington, DC 20594

Commander
10th Medical Laboratory
ATTN: Audiologist
APO New York 09180

Naval Air Development Center
Technical Information Division
Technical Support Detachment
Warminster, PA 18974

Commanding Officer, Naval Medical Research and Development Command
National Naval Medical Center
Bethesda, MD 20814-5044

Deputy Director, Defense Research and Engineering
ATTN: Military Assistant for Medical and Life Sciences
Washington, DC 20301-3080

Commander, U.S. Army Research Institute of Environmental Medicine
Natick, MA 01760

Library
Naval Submarine Medical Research Lab
Box 900, Naval Sub Base
Groton, CT 06349-5900

Executive Director, U.S. Army Human Research and Engineering Directorate
ATTN: Technical Library
Aberdeen Proving Ground, MD 21005

Commander
Man-Machine Integration System
Code 602
Naval Air Development Center
Warminster, PA 18974

Commander
Naval Air Development Center
ATTN: Code 602-B
Warminster, PA 18974

Commanding Officer
Armstrong Laboratory
Wright-Patterson
Air Force Base, OH 45433-6573

Director
Army Audiology and Speech Center
Walter Reed Army Medical Center
Washington, DC 20307-5001

Commander/Director
U.S. Army Combat Surveillance and Target Acquisition Lab
ATTN: SFAE-IEW-JS
Fort Monmouth, NJ 07703-5305

Director
Federal Aviation Administration
FAA Technical Center
Atlantic City, NJ 08405

Director
Walter Reed Army Institute of Research
Washington, DC 20307-5100

Commander, U.S. Army Test
and Evaluation Command
Directorate for Test and Evaluation
ATTN: AMSTE-TA-M (Human Factors
Group)
Aberdeen Proving Ground,
MD 21005-5055

Naval Air Systems Command
Technical Air Library 950D
Room 278, Jefferson Plaza II
Department of the Navy
Washington, DC 20361

Director
U.S. Army Ballistic
Research Laboratory
ATTN: DRXBR-OD-ST Tech Reports
Aberdeen Proving Ground, MD 21005

Commander
U.S. Army Medical Research
Institute of Chemical Defense
ATTN: SGRD-UV-AO
Aberdeen Proving Ground,
MD 21010-5425

Commander
USAMRMC
ATTN: SGRD-RMS
Fort Detrick, Frederick, MD 21702-5012

HQ DA (DASG-PSP-O)
5109 Leesburg Pike
Falls Church, VA 22041-3258

Harry Diamond Laboratories
ATTN: Technical Information Branch
2800 Powder Mill Road
Adelphi, MD 20783-1197

U.S. Army Materiel Systems
Analysis Agency
ATTN: AMXSY-PA (Reports Processing)
Aberdeen Proving Ground
MD 21005-5071

U.S. Army Ordnance Center
and School Library
Simpson Hall, Building 3071
Aberdeen Proving Ground, MD 21005

U.S. Army Environmental
Hygiene Agency
ATTN: HSHB-MO-A
Aberdeen Proving Ground, MD 21010

Technical Library Chemical Research
and Development Center
Aberdeen Proving Ground, MD
21010-5423

Commander
U.S. Army Medical Research
Institute of Infectious Disease
ATTN: SGRD-UIZ-C
Fort Detrick, Frederick, MD 21702

Director, Biological
Sciences Division
Office of Naval Research
600 North Quincy Street
Arlington, VA 22217

Commandant
U.S. Army Aviation
Logistics School ATTN: ATSQ-TDN
Fort Eustis, VA 23604

Headquarters (ATMD)
U.S. Army Training
and Doctrine Command
ATTN: ATBO-M
Fort Monroe, VA 23651

IAF Liaison Officer for Safety
USAF Safety Agency/SEFF
9750 Avenue G, SE
Kirtland Air Force Base
NM 87117-5671

Naval Aerospace Medical
Institute Library
Building 1953, Code 03L
Pensacola, FL 32508-5600

Command Surgeon
HQ USCENTCOM (CCSG)
U.S. Central Command
MacDill Air Force Base, FL 33608

Director
Directorate of Combat Developments
ATTN: ATZQ-CD
Building 515
Fort Rucker, AL 36362

U.S. Air Force Institute
of Technology (AFIT/LDEE)
Building 640, Area B
Wright-Patterson
Air Force Base, OH 45433

Henry L. Taylor
Director, Institute of Aviation
University of Illinois-Willard Airport
Savoy, IL 61874

Chief, National Guard Bureau
ATTN: NGB-ARS
Arlington Hall Station
111 South George Mason Drive
Arlington, VA 22204-1382

AAMRL/HEX
Wright-Patterson
Air Force Base, OH 45433

Commander
U.S. Army Aviation and Troop Command
ATTN: AMSAT-R-ES
4300 Goodfellow Bouvelard
St. Louis, MO 63120-1798

U.S. Army Aviation and Troop Command
Library and Information Center Branch
ATTN: AMSAV-DIL
4300 Goodfellow Boulevard
St. Louis, MO 63120

Federal Aviation Administration
Civil Aeromedical Institute
Library AAM-400A
P.O. Box 25082
Oklahoma City, OK 73125

Commander
U.S. Army Medical Department
and School
ATTN: Library
Fort Sam Houston, TX 78234

Commander
U.S. Army Institute of Surgical Research
ATTN: SGRD-USM
Fort Sam Houston, TX 78234-6200

Air University Library
(AUL/LSE)
Maxwell Air Force Base, AL 36112

Product Manager
Aviation Life Support Equipment
ATTN: SFAE-AV-LSE
4300 Goodfellow Boulevard
St. Louis, MO 63120-1798

Commander and Director
USAE Waterways Experiment Station
ATTN: CEWES-IM-MI-R,
CD Department
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Commanding Officer
Naval Biodynamics Laboratory
P.O. Box 24907
New Orleans, LA 70189-0407

Assistant Commandant
U.S. Army Field Artillery School
ATTN: Morris Swott Technical Library
Fort Sill, OK 73503-0312

Mr. Peter Seib
Human Engineering Crew Station
Box 266
Westland Helicopters Limited
Yeovil, Somerset BA20 2YB UK

U.S. Army Dugway Proving Ground
Technical Library, Building 5330
Dugway, UT 84022

U.S. Army Yuma Proving Ground
Technical Library
Yuma, AZ 85364

AFFTC Technical Library
6510 TW/TSTL
Edwards Air Force Base,
CA 93523-5000

Commander
Code 3431
Naval Weapons Center
China Lake, CA 93555

Aeromechanics Laboratory
U.S. Army Research and Technical Labs
Ames Research Center, M/S 215-1
Moffett Field, CA 94035

Sixth U.S. Army
ATTN: SMA
Presidio of San Francisco, CA 94129

Commander
U.S. Army Aeromedical Center
Fort Rucker, AL 36362

Strughold Aeromedical Library
Document Service Section
2511 Kennedy Circle
Brooks Air Force Base, TX 78235-5122

Dr. Diane Damos
Department of Human Factors
ISSM, USC
Los Angeles, CA 90089-0021

U.S. Army White Sands
Missile Range
ATTN: STEWS-IM-ST
White Sands Missile Range, NM 88002

Director, Airworthiness Qualification Test
Directorate (ATTC)
ATTN: STEAT-AQ-O-TR (Tech Lib)
75 North Flightline Road
Edwards Air Force Base, CA 93523-6100

Ms. Sandra G. Hart
Ames Research Center
MS 262-3
Moffett Field, CA 94035

Commander
USAMRMC
ATTN: SGRD-UMZ
Fort Detrick, Frederick, MD 21702-5009

Commander
U.S. Army Health Services Command
ATTN: HSOP-SO
Fort Sam Houston, TX 78234-6000

U. S. Army Research Institute
Aviation R&D Activity
ATTN: PERI-IR
Fort Rucker, AL 36362

Commander
U.S. Army Safety Center
Fort Rucker, AL 36362

U.S. Army Aircraft Development
Test Activity
ATTN: STEBG-MP-P
Cairns Army Air Field
Fort Rucker, AL 36362

Commander
USAMRMC
ATTN: SGRD-PLC (COL R. Gifford)
Fort Detrick, Frederick, MD 21702

TRADOC Aviation LO
Unit 21551, Box A-209-A
APO AE 09777

Netherlands Army Liaison Office
Building 602
Fort Rucker, AL 36362

British Army Liaison Office
Building 602
Fort Rucker, AL 36362

Italian Army Liaison Office
Building 602
Fort Rucker, AL 36362

Directorate of Training Development
Building 502
Fort Rucker, AL 36362

Chief
USAHEL/USAAVNC Field Office
P. O. Box 716
Fort Rucker, AL 36362-5349

Commander, U.S. Army Aviation Center
and Fort Rucker
ATTN: ATZQ-CG
Fort Rucker, AL 36362

Dr. Sehchang Hah
Dept. of Behavior Sciences and
Leadership, Building 601, Room 281
U. S. Military Academy
West Point, NY 10996-1784

Canadian Army Liaison Office
Building 602
Fort Rucker, AL 36362

German Army Liaison Office
Building 602
Fort Rucker, AL 36362

French Army Liaison Office
USAAVNC (Building 602)
Fort Rucker, AL 36362-5021

Australian Army Liaison Office
Building 602
Fort Rucker, AL 36362

Dr. Garrison Rapmund
6 Burning Tree Court
Bethesda, MD 20817

Commandant, Royal Air Force
Institute of Aviation Medicine
Farnborough, Hampshire GU14 6SZ UK

Defense Technical Information
Cameron Station, Building 5
Alexandra, VA 22304-6145

Commander, U.S. Army Foreign Science
and Technology Center
AIFRTA (Davis)
220 7th Street, NE
Charlottesville, VA 22901-5396

Commander
Applied Technology Laboratory
USARTL-ATCOM
ATTN: Library, Building 401
Fort Eustis, VA 23604

Commander, U.S. Air Force
Development Test Center
101 West D Avenue, Suite 117
Eglin Air Force Base, FL 32542-5495

Aviation Medicine Clinic
TMC #22, SAAF
Fort Bragg, NC 28305

Dr. H. Dix Christensen
Bio-Medical Science Building, Room 753
Post Office Box 26901
Oklahoma City, OK 73190

Commander, U.S. Army Missile
Command
Redstone Scientific Information Center
ATTN: AMSMI-RD-CS-R
/ILL Documents
Redstone Arsenal, AL 35898

Aerospace Medicine Team
HQ ACC/SGST3
162 Dodd Boulevard, Suite 100
Langley Air Force Base,
VA 23665-1995

U.S. Army Research and Technology
Laboratories (AVSCOM)
Propulsion Laboratory MS 302-2
NASA Lewis Research Center
Cleveland, OH 44135

Commander
USAMRMC
ATTN: SGRD-ZC (COL John F. Glenn)
Fort Detrick, Frederick, MD 21702-5012

Dr. Eugene S. Channing
166 Baughman's Lane
Frederick, MD 21702-4083

U.S. Army Medical Department
and School
USAMRDALC Liaison
ATTN: HSMC-FR
Fort Sam Houston, TX 78234

NVESD
AMSEL-RD-NV-ASID-PST
(Attn: Trang Bui)
10221 Burbeck Road
Fort Belvior, VA 22060-5806

CA Av Med
HQ DAAC
Middle Wallop
Stockbridge, Hants S020 8DY UK

Dr. Christine Schlichting
Behavioral Sciences Department
Box 900, NAVUBASE NLON
Groton, CT 06349-5900

Commander
Aviation Applied Technology Directorate
ATTN: AMSAT-R-TV
Fort Eustis, VA 23604-5577

COL Yehezkel G. Caine, MD
Surgeon General, Israel Air Force
Aeromedical Center Library
P. O. Box 02166 I.D.F.
Israel

HQ ACC/DOHP
205 Dodd Boulevard, Suite 101
Langley Air Force Base,
VA 23665-2789

41st Rescue Squadron
41st RQS/SG
940 Range Road
Patrick Air Force Base,
FL 32925-5001

48th Rescue Squadron
48th RQS/SG
801 Dezonia Road
Holloman Air Force Base,
NM 88330-7715

HQ, AFOMA
ATTN: SGPA (Aerospace Medicine)
Bolling Air Force Base,
Washington, DC 20332-6128

ARNG Readiness Center
ATTN: NGB-AVN-OP
Arlington Hall Station
111 South George Mason Drive
Arlington, VA 22204-1382

35th Fighter Wing
35th FW/SG
PSC 1013
APO AE 09725-2055

66th Rescue Squadron
66th RQS/SG
4345 Tyndall Avenue
Nellis Air Force Base, NV 89191-6076

71st Rescue Squadron
71st RQS/SG
1139 Redstone Road
Patrick Air Force Base,
FL 32925-5000

Director
Aviation Research, Development
and Engineering Center
ATTN: AMSAT-R-Z
4300 Goodfellow Boulevard
St. Louis, MO 63120-1798

Commander
USAMRMC
ATTN: SGRD-ZB (COL C. Fred Tyner)
Fort Detrick, Frederick, MD 21702-5012

Commandant
U.S. Army Command and General Staff
College
ATTN: ATZL-SWS-L
Fort Levenworth, KS 66027-6900

Director
Army Personnel Research Establishment
Farnborough, Hants GU14 6SZ UK

Dr. A. Kornfield
895 Head Street
San Francisco, CA 94132-2813

Mr. George T. Singley, III
Depupty Assistant Secretary of the Army
for Research and Technology
and Chief Scientist
ATTN: Room 3E374
103 Army Pentagon
Washington, DC 20310-0103

The Honorable Gilbert F. Decker
Assistant Secretary of the Army
for Research, Development,
and Acquisition
ATTN: Room 2E672
103 Army Pentagon
Washington, DC 20310-0103

Dr. Craig Dorman
Office of the Deputy Director,
Defense Research and Engineering
ATTN: Room 3D129LM
103 Army Pentagon
Washington, DC 20310-0103

HQ, AFOMA
ATTN; SGPA (Aerospace Medicine)
Bolling Air Force Base,
Washington, DC 20332-6188

Cdr, PERSCOM
ATTN: TAPC-PLA
200 Stovall Street, Rm 3N25
Alexandria, VA 22332-0413